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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

The L.M.S.R. Dividend

ALTHOUGH the announcement by the L.M.S.R. of a dividend of 1½ per cent. on the ordinary stock proved a disappointment to certain sections of the market, it compares with 1¼ per cent. a year ago, and fulfils the forecasts of the more conservative elements. The clear statement of Sir William Wood, which we published in our issue of January 14, gave the earliest possible indication that the large increase in total receipts was offset by additional expenditure to a larger extent than was generally thought. The figures issued with the dividend announcement show that the company's net revenue from all sources amounted in 1937 to £14,356,000, which is an increase of £308,000 over 1936 despite that being a leap year. Actually, the railway net revenue was up by £384,000, as railway receipts increased during the year by £2,771,000, and corresponding expenditure by £2,387,000. It was "other businesses" that provided a setback of £76,000, as the increased receipts from these sources (£367,000) were obtained only at the cost of £443,000 in increased expenditure. Of the total increase in expenditure (£2,830,000), approximately £1,875,000, or 60 per cent. of the increased receipts, is due to increased prices of materials and rates of wages, and only £955,000 (30 per cent.) due to the additional volume of business.

Joshua Shaw of the Mersey Railway

In the offices of General Manager, Engineer, and Secretary of the Mersey Railway which he will relinquish on his retirement next week, Mr. Joshua Shaw holds a somewhat unusual combination of responsibilities to which he may claim a peculiar right, having previously filled a similarly comprehensive appointment with the Isle of Man Electric Tramways. As will be seen from the biographical notice on page 316, however, most of his career has been spent with the Mersey Railway, extending over a period which began with its electrification in 1902 (the first such conversion of a steam line in this country), witnessed the jubilee of opening to public traffic on February 1, 1936, and has concluded with the works in preparation for a new sphere of usefulness of the railway as the means by which for the first time electric trains will be able to run through from the resorts in the Wirral peninsular to the centre of Liverpool. It is an unusual combination of circumstances when a railway officer's career not only coincides so exactly with important landmarks in the history of his company, but allows him to contribute to the intervening period of development in engineering, adminstrative, and secretarial capacities.

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The Week's Traffics

Coal contributes £17,000, merchandise £53,000, and passenger train traffic £19,000 to the combined increase of £89,000 in receipts shown by the four main-line railways for the past week. The combined increase for the year to date is now £740,000 on aggregate takings of £17,264,000, or 4·47 per cent. Total takings for the past week were L.M.S.R. £1,189,000, L.N.E.R. £886,000, G.W.R. £477,000, and Southern Railway £354,000, representing increases over the corresponding period of last year of £39,000, £35,000, £11,000, and £4,000 respectively.

	6th Week				Year to date
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec
	£	£	£	£	£ %
L.M.S.R. ..	+ 9,000	+ 19,000	+ 11,000	+ 39,000	+ 313,000 + 4·50
L.N.E.R. ..	+ 1,000	+ 26,000	+ 8,000	+ 35,000	+ 259,000 + 5·21
G.W.R. ..	+ 5,000	+ 7,000	− 1,000	+ 11,000	+ 119,000 + 4·29
S.R.	+ 4,000	+ 1,000	− 1,000	+ 4,000	+ 59,000 + 2·87

Great Northern (I) traffics for the past week, totalling £16,500, show an increase of £750; Great Southern, totalling £67,429, an increase of £1,221; and Belfast and County Down, totalling £1,600, a decrease of £63. Mersey Railway receipts total £4,192, an increase of £161; and Liverpool Overhead £1,308, an increase of £160.

* * * *

Mersey Railway Company

Passengers carried in 1937 again showed an increase, the number of 15,766,441 being 322,628 higher. Passenger receipts rose by £3,450 to £185,115. There were also more season ticket holders in both classes, first class seasons increasing in number by 71, and third class by 201. A considerable increase—314,010—was recorded in passenger journeys originating on the company's system. Traffic expenses were £1,741 higher, contributing to a slight increase, from 58·81 to 59·32 per cent., in operating ratio. Other results are compared in the following table:—

	1937	1936	1935
	£	£	£
Gross receipts	221,560	217,012	211,552
Expenditure	131,457	127,640	125,896
Net receipts	90,103	89,372	85,656
Net revenue	89,006	89,049	85,955
Deb. and pref. payments ..	75,615	75,615	75,615
Ordinary dividend	12,357	12,357	12,357
Carried forward	2,201	2,167	2,090

The ordinary dividend of ⅞ per cent. is the same as last

year, and a sum of £1,000 is again appropriated to general reserve. Mr. Shaw, whose retirement is recorded in a previous note, has been invited to join the board.

* * * *

Belfast & County Down Railway

Gross railway receipts in 1937 decreased by £3,329 to £156,338, and expenditure was reduced by £2,824, leaving net receipts of £4,198, or a decrease of £505. The undertaking as a whole earned a net income of £14,842, which was £623 lower than in the preceding year. Interest from Northern Ireland Road Transport Board stocks contributed £205 less than in 1936. Hotels and refreshment rooms business, which showed a decrease of £788 in 1936, remained almost unchanged last year at £4,061, against £4,094. The general financial position is compared in the following table:—

	1937	1936	1935
	£	£	£
Gross receipts from businesses	178,914	183,117	198,391
Net receipts from businesses..	8,259	8,797	10,142
Miscellaneous receipts, net ..	6,582	6,668	5,650
Total net income	14,842	15,465	15,792
Prior charges	13,940	13,940	13,972
Dividend on baronial guaranteed shares and 4½ per cent. preference stock	1,635	1,635	1,635
Brought forward	1,767	1,877	1,692
Carried forward	1,034	1,767	1,877

Profits in the last six months of 1937 suffice for the interest of the 4½ per cent. "A" preference stock for that period, but not for that of the 5 per cent. or 4 per cent. preferences. Twenty carriages were re-upholstered in 1937, and ten wagons built to replace existing stock. A diesel-electric locomotive was placed in service on the Ardglass branch.

* * * *

Northern Ireland Transport Board

The first annual report and accounts of the Northern Ireland Road Transport Board, for the year ended September 30, 1936, show an operating loss of £40,838. A sum of £5,850, payable by the railway companies in Northern Ireland under the pooling scheme, was included in the revenue. Expenditure accounted for £599,600 and, with a depreciation allowance of £117,969 giving a total of £717,569, there was an operating loss of £40,838 on total receipts of £676,731. The revenue was made up as follows: ordinary passenger fares, £434,142; weekly, £45,626; monthly, £40,359; private hire excursions, £61,398; parcels, luggage, and mails, £26,891; and merchandise, £62,465. Passenger vehicle-miles totalled 14,353,975, and goods vehicle-miles 1,359,841. Capital expenditure was £1,208,606, and the stock issued and outstanding at the end of the year was £807,278. Working expenses included £566,626 for buses and coaches, £77,326 for goods vehicles, and £73,617 general expenses. In the course of the report the Chairman, Mr. D. L. Clarke, stresses that conditions during the first year were abnormal, and remarks that "the board views with alarm the extent to which the intention of Section 15 of the Act is being evaded." This section forbids anyone, other than the board, to carry goods or passengers for hire or reward by road transport. The transport board has been authorised by Parliament to pay the dividends on transport stock for a period of five years out of capital. The directors of the railways in Northern Ireland are displaying some anxiety in regard to the demands which may be made upon the railway companies under the traffic pooling scheme.

* * * *

Railway Wages

The announcement of the increased dividends to be paid by the main-line railway companies was at once followed by the formulation of a programme for presentation to the companies by the Railway Clerks' Association. A special delegate conference met last week-end and voted upon various proposals for improvements in salaries and conditions of service which had been suggested by the membership. Thus there emerged a short but important programme, outlined on page 318 of this issue, and including, once more, a claim for a reduction in the length of the working week. In 1937 the association asked for—and failed to get—a 36-hour week. Apparently it now hopes that the modest request for a 40-hour week may succeed. Mr. Stott, the General Secretary, has indicated that the association will not present the new programme before consultation with the other two unions has taken place. This is interesting, for it will be remembered that the Railway Staff National Tribunal has already expressed quite definite views as to the simultaneous presentment of claims. It is, perhaps, only natural that news of the larger distribution to the shareholders should influence the unions in deciding to ask, on behalf of the staffs, for a larger share of the profits earned, but it is to be hoped that in framing and presenting their claims the unions will not overlook the dictum of the tribunal that "the extent of any practical concessions is, of course, limited by the financial position and prospects of the companies."

* * * *

"On Time" Extended

Several keen struggles in the closing stages of the L.M.S.R. punctuality competition for 1937 show the invigorating effects of the scheme on operating enterprise. The Central Division has now performed a hat trick by winning the express contest in three successive years, and the Midland Division earns a similar distinction by the performance of three of its districts—Somerset & Dorset Joint, Skipton, and Melton Mowbray—in taking first place in the three English and Welsh local passenger train leagues. The end of three successful years is an opportune moment for the announcement in *On Time* this month that the principle of inter-divisional competitive operating is to be extended by launching a similar scheme for goods trains. Mr. C. R. Byrom, Chief Operating Manager, explains the principle of the new competition in a leading article. Scoring will be based on wagon-miles per engine-hour, the performance in this respect of the four divisions being increased by a percentage representing the improvement to be aimed at; attainment of the resulting figure will confer the maximum score of 1,000 points. At the same time a new method of competition is announced for the local passenger leagues, designed to give a better chance to districts hitherto handicapped by circumstances beyond their control.

* * * *

The British Railways' Research Service

In suggesting avenues for railway research, the editorial on this subject in our issue last week emphasised the important principle of having a central department to co-ordinate and direct the research efforts of all systems. Such a centralised research service, to cover managerial and economic questions, was set up by the British railways as early as 1924, only one year after grouping became effective. The Railway Research Service, jointly managed by the four main-line railways, carries the conception of co-operative research even farther than that of

the Association of American Railroads, of which it is incidentally an associate member, because it is supported also by the London Passenger Transport Board and the Anglo-Argentine railways. Modelled originally on the Bureau of Railway Economics at Washington, it now acts as a liaison between the British railways and railways overseas to ensure the automatic dissemination, in both directions, of economic and technical information likely to be of value to all railway departments; on more than one occasion, it has acted as the link between the railway systems of two countries abroad, for instance, Argentina and Germany; France and the United States; or perhaps Canada and Switzerland. Its reports have covered a wide range of subjects from mechanised marshalling yards to continuous rail welding; from the theory of rates and fares to Government operation and control; and from rail lubricators to ticket printing and issuing machines. It is of interest that the French railways have often suggested setting up an office run on similar lines, and Argentina and Japan have actually established organisations based on the British railways' model.

* * * *

Non-Stop Running

The economic considerations which regulate the introduction of lengthy non-stop runs into passenger timetables are of various kinds. First among them, of course, is the necessity of securing a paying load over the length of the run, to justify the running of a non-stop service as well as of trains making intermediate stops at the principal stations *en route*. From the operating point of view, apart from the actual cost of duplication, there are advantages in splitting into two what otherwise would be heavy and cumbrous train formations providing sufficient seating both for the short-distance and long-distance passengers. The latter have everything to gain by the duplication, as they are thus enabled to make their lengthy journeys without disturbance and, probably, in a considerably shorter time, by reason of the excision of stops. An article on p. 320 of this issue shows that the tendency to reduce the number of long non-stop runs, as an economy measure during the trade depression, has now been reversed, and that by the introduction, in particular, of streamlined steam and diesel-electric high-speed trains, many new runs of great length have come into being. This is one element of operating in which Great Britain is pre-eminent in the railway world, as the eight longest non-stop runs in summer, and the four longest in winter, are all performed on British metals; furthermore, steam here holds the supremacy over both electric and diesel propulsion.

* * * *

Dirty Signal Arms

In the days of painted signal arms the regular appearance of a gang of men who went round repainting them was a familiar sight. The result of their efforts was not very lasting in some places, and long before the time for repainting arrived the arms were dull and covered with grime. The arrival of the enamelled arm with its brilliant, attractive colour, saved the trouble and expense of repainting, and made it possible to give drivers distinctly visible signals at all times with practically no trouble. It is much to be regretted that full advantage is not being taken of this excellent facility, and that the enamelled signals are allowed to go for long periods without being touched, until in many places they are so coated with grime as to be nearly indistinguishable from their surroundings, the distant signals assuming a sort of khaki colour, about the worst for visibility. If a lineman let his colour-light signal lenses become so covered with dirt that the light was nearly obliterated he would soon and properly be called to account, yet signal arms, which could be cleaned in a few moments, are so little regarded that they are allowed to become utterly black. It is just as necessary to be able to see the one kind of signal as the other, and we hope a better state of things will come about in this matter before long, as brightly-coloured arms are a great help to drivers, especially in these days of low signals without sky backgrounds.

* * * *

Air-Conditioning with Water Sprays

For two passenger cars and three combination buffet coaches built during the past summer by the Pullman-Standard Car Manufacturing Company for the Bangor & Aroostook Railroad, a system of air-conditioning particularly suitable for a more temperate climate such as our own was devised, the co-operating experts in this instance being the Sturtevant Company. Usually, the air is conditioned in trains by a coil which carries cold water in summer and warm water in winter, and dirt deposits on such coils frequently give rise to odours. In the Sturtevant system cooling is effected by a spray of water, which cannot possibly cause odours. Indeed, this spray is claimed to take into solution the gases and solid particles which give rise to disagreeable smells, and to produce general cleansing of the air. A settling tank, or reservoir, is provided in the water circuit so that impurities fall out to form a sludge instead of being kept in circulation. During the summer 75 per cent. of the air conditioned is recirculated air, and the water is passed over ice before proceeding to the sprays. When atmospheric conditions permit, the water is caused to bypass the ice tank so that it produces cooling by evaporation only. At the same time only fresh outside air is introduced. In winter, when the operation of the usual sprays would lead to condensation in the car, the sterilisation duties are taken over by ultra-violet lamps consuming 460 watts, and a steam-heated radiator is brought into use.

* * * *

Obsolete Machinery in Railway Shops

It has been pointed out many times that it is uneconomical to continue an obsolete machine tool in service, for, thanks to modern improvements, a smaller number of new machines will almost certainly be capable of doing more and better work than the old ones they displace. The advance in the last 10 years alone in the art of metal cutting makes it certain that a 20-year-old machine tool must be classed as obsolete. This is a matter which concerns railway shops all over the world, and a thoughtful article recently published in our American contemporary the *Railway Age*, stated that in the U.S.A. something over 70 per cent. of the machines in the average railway shop are over 20 years old, and that in one case 13 old machines in a single group were taken out and replaced by 5 new ones, affording a saving of 65 per cent. in the cost of the parts produced in the department. The savings arising from new plant do not concern the reduction in cost of maintenance alone, but also reduce electric power consumption, and effect economies by the higher grade of workmanship. There are many cases in which individual units of new shop equipment have paid for themselves in from one to 2½ years. The full significance of the actual cost of operating obsolete machine-tool equipment is seldom realised by those who are forced to get along as best they can with it, because the many inconveniences ensuing often leave little opportunity to study the potentialities of new tools.

XUM

Southern Railway

GROSS receipts from businesses carried on by the Southern Railway Company during 1937 were £25,580,836, the largest total since 1930, and £1,312,769 more than in 1936. As we remarked last week, the public weekly traffic returns for 52 weeks of 1937 showed a total gross increase of £731,000, and this has proved to be a conservative indication of the precise figures, for total traffic receipts in respect of railway working at £21,850,422 are £841,153 up on the year. In 1937 passenger train receipts accounted for 76·51 (against 75·70 in 1936) per cent., and goods train receipts 22·30 (against 23·14). Railway working expenses increased from £16,474,211 to £17,243,732, a difference of £769,521. After allowing for a slight increase in miscellaneous receipts, the net receipts of railway working (at £4,869,848) show an improvement of £87,645. The operating ratio of 77·98 compares with 77·50 per cent. in 1936. The net revenue for the year shows the substantial improvement of £325,964. What we suggested last week has proved to be the case, namely, that the remarkable extension of the traffic conveyed by the company's cross-Channel steamboats has provided a considerable proportion of the total increase in net revenue. The gross receipts from this traffic at £1,465,232 compare with £1,124,800 in 1936, while the respective expenditure figures are £1,127,690 and £1,023,741, so that the net receipts for 1937 are £337,542 compared with £101,059, an improvement of no less than £236,483. Net receipts from docks, harbours, and wharves are £379,444, against £357,653. On the collection and delivery of parcels and goods, however, net receipts fell from £20,171 to £10,631. Net receipts from hotels where catering is carried on by the company increased from £8,710 to £17,435, this results from total receipts showing the substantial difference of £147,518 in 1937 against £139,900 in 1936, while expenditure actually decreased from £132,769 in 1936 to £125,554. The main item to drop was some £10,900 in maintenance of hotels, possibly because the directors took advantage of a favourable opportunity during the year of disposing of the South Eastern Hotel, Deal. On air transport the company's loss was £5,103, against £4,348 in 1936 and £8,988 in 1935. Results are compared in the accompanying table:—

	1937	1936	1935
	£	£	£
Total expenditure on capital account	171,495,577	169,144,332	167,425,314
Gross receipts from businesses carried on by the company	25,580,836	24,268,069	23,517,026
Revenue expenditure on ditto	19,963,749	18,994,747	18,476,400
Net receipts of ditto	5,617,087	5,273,322	5,040,626
"J" Joint Lines—company's proportion of net revenue	42,388	*Dr.* 37,345	*Dr.* 41,383
Miscellaneous receipts (net)	1,237,503	1,243,225	1,310,909
Miscellaneous charges	260,078	253,042	237,855
Net revenue	6,552,124	6,226,160	6,072,297
Interest on loans and debenture stocks, &c.	1,943,167	1,943,167	1,943,167
Dividends on guaranteed preference and stocks	2,751,278	2,751,278	2,751,278
Balance after payment of preference dividends	1,857,679	1,531,715	1,377,852
Dividend on ordinarystocks	1,851,684	1,536,781	1,379,330
Rate per cent.:—			
Preferred ordinary	5	5	5
Deferred ordinary	1½	½	—
Surplus or deficit (+ or —)	+ 5,995	— 5,066	— 1,478
Balance brought forward from previous year	220,809	225,875	227,353
Balance carried forward to subsequent year	226,804	220,809	225,875

Electrification progress is referred to in a news article on page 321. Among the engineering works of the year are the completion and opening in July last of a new line from a point between Lydd and Dungeness to New Romney (see our issue of July 9, 1937, page 80). Progress on the Chessington line was recorded in a news paragraph last week. Colour-light signalling is being installed between Victoria and Battersea Park junction; and has been brought into use on the Brighton main line between Coulsdon and Purley; and on the Portsmouth line at Portsmouth Harbour, at Haslemere, between Havant west and Farlington junction, and between Woking and Guildford. Modernisation of 43 stations was carried out during the year, and work on others is well in hand. Reference is made in the report to the retirement of Sir Herbert Walker, General Manager; Mr. W. Bishop, Solicitor; and Mr. R. E. L. Maunsell, Chief Mechanical Engineer; and the appointment of their respective successors, namely, Messrs. Gilbert S. Szlumper, H. L. Smedley, and O. V. Bulleid. Also, as we record on page 305, the directors recommend the election to the board of Sir Herbert Walker, the late General Manager, to succeed Mr. F. Dudley Docker, who is to retire owing to pressure of other work. A peculiar situation arose through the death during the year of two of the three auditors. As it is necessary for two to certify the annual accounts of the company, the Minister of Transport had to be asked to appoint an auditor under Section 12 of the Regulation of Railways Act, 1868.

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Great Western Railway

THE announcement of the G.W.R. ordinary dividend at 4 per cent. was very much in accordance with market expectations. It is the highest figure since 1930, when 5½ per cent. was paid, and the official intimation given on Friday last stated that net revenue was £6,886,505 for 1937 against £6,314,829 in the previous year, a net increase of £571,676. Dividends on the ordinary stock for the past nine years have been as follow:—

	1929	1930	1931	1932	1933	1934	1935	1936	1937
	%	%	%	%	%	%	%	%	%
Ord. stock	7½	5½	3	3	3	3	3	3	4

The gratifying increase in revenue during the past year is accompanied by such welcome features as the improvement of the export coal trade and the establishment of new factories in South Wales and elsewhere on the company's system. In order to deal with the increased volume of traffic it has been necessary to provide further rolling stock and to run more miles. Total train miles, for example, were 68,637,232, against 67,629,023, and total engine miles (including shunting, and so forth) were 100,791,114, against 98,271,371. The main increase in expenditure, however, was due to the part restoration of deductions from salaries and wages; to wage concessions; and to the rise in commodity prices during the latter part of the year. The percentage deduction from staff earnings ceased on August 16, and standard rates for night duty and Sunday duty were restored. Results for the past three years are compared in the table at the top of the opposite page.

Gross receipts in respect of railway working were £28,110,846 (against £26,729,440 in 1936), and total expenditure was £21,792,828 (against £20,814,141). Railway working receipts, therefore, increased by £1,381,406 and expenses by £978,687. This accounted thus for an increase of £402,719 in net receipts; the operating ratio was reduced to 77·52 per cent. from 77·87 in 1936 and 80·66 in 1935. Steamboat net receipts are up from £17,595 in 1936 to £19,951 last year; and docks, harbours, and wharves show the substantial increase of £122,681 from £119,701 in 1936 to £342,382 last year. The com-

	1937 £	1936 £	1935 £
Total expenditure on capital account ..	185,390,751	184,695,041	184,072,637
Gross receipts from businesses carried on by the company	32,586,547	30,763,033	29,788,622
Revenue expenditure on ditto	26,121,445	24,839,821	24,817,604
Net receipts of ditto ..	6,465,102	5,923,212	4,971,018
"J" Joint Lines—company's proportion of net revenue	145,949	140,887	141,107
Miscellaneous receipts (net)	1,090,562	1,039,222	1,114,271
Miscellaneous charges ..	815,108	788,492	775,837
Net revenue	6,886,505	6,314,829	5,450,559
Profit on realisation of investments	—	—	122,990
Rates and rate relief recoverable to December 31, 1935	—	1,737,800	—
Appropriation to contingency fund ..	—	*Dr.* 1,737,800	—
Appropriation to New Works — Railways (Agreement) Act, 1935 —Revenue Proportion Suspense	*Dr.* 100,000	—	—
Interest on loans and debenture stocks ..	1,649,832	1,649,818	1,649,811
Dividends on rent charge, guaranteed and preference stocks	3,344,699	3,344,699	3,344,699
Balance after payment of preference dividends	1,791,974	1,320,312	579,039
Dividend on ordinary stock	1,717,189	1,287,892	1,287,892
Rate per cent.	4	3	3
Surplus or deficit (+ or −)	+ 74,785	+ 32,420	− 708,853
Appropriation from contingency fund ..	—	—	710,000
Balance brought forward from previous year ..	76,793	44,373	43,226
Balance carried forward to subsequent year ..	151,578	76,793	44,373

pany's loss in connection with air transport was £9,830 last year, compared with £8,712 in 1936. On the collection and delivery of parcels and goods a loss of £240,080 is shown, against £197,652 in the previous accounting period. In 1937 passenger train receipts accounted for 40·87 per cent. (against 41·39 per cent.) of railway working receipts, and goods train receipts 58·21 per cent. (against 57·69 per cent.). The accompanying table shows the approximate allocation of receipts in 1937:—

	Amount £	Amount per £ s.	d.
Salaries and wages	17,850,000	11	0
Coal	1,950,000	1	2
Other material	3,700,000	2	3
Rates and sundry items, *less* miscellaneous receipts	2,400,000	1	6
	25,900,000	15	11
Interest and dividends on capital ..	6,700,000	4	1
	£32,600,000	20	0

The quadrupling of the line between Wood Lane and North Acton in pursuance of the provisions of the London Passenger Transport (Agreement) Act, 1935, has now been completed, and a contract has been let for the widening of the continuation between North Acton and Greenford stations. Good progress has also been made with the various schemes undertaken in accordance with the arrangements embodied in the Railways (Agreement) Act, 1935, which include the reconstruction of stations and incidental work at Plymouth (North Road), Paignton, and Penzance, and the re-modelling of the goods depots at Hockley. The Minister of Transport has agreed to extend for a period of four years to January, 1945, the date for completion of the proposed Dawlish deviation line, the new branch line to Looe, and the re-construction of Exeter, Oxford, Llanelly, and Weymouth stations, which are other schemes contemplated by the Railways (Agreement) Act, 1935. The modernisation of the Royal Hotel at Paddington is approaching completion, and the re-construction of Leamington station is well in hand.

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South African Railways and Harbours

THE results of working of the South African Railways for the year ended March 31, 1937, confirmed the forecast made in the previous year by the General Manager, Mr. T. H. Watermeyer, from whom we have now received a copy of his annual report. The administration also publishes a shorter report for each calendar year, and that of 1936 was noticed in THE RAILWAY GAZETTE of January 14 last, at page 56. The favourable conditions which continue to prevail in the Union are reflected in the aggregate figures. A surplus is shown for the combined service of railways, harbours, steamships and airways, after deducting working expenses, interest and special appropriations (totalling £5,340,204) of £1,730,482, and adding the balance from the previous year (£125,155) a net surplus is carried forward of £1,855,637. In the previous financial year the amount available was £3,245,724, but this was reduced by certain special appropriations totalling £3,500,000. Excluding the net revenue appropriations the actual financial results of working for 1936-37 showed a surplus of £7,070,686, as compared with a surplus of £6,101,542 in the previous period. For railways only the surplus was £6,464,021, against £5,623,158. The report says the policy is to be continued of taking advantage of the present prosperity to strengthen the financial resources of the railways. The extraordinary buoyancy of railway revenue is in the first place due to the unparalleled activity in gold mining with its stimulating effect on industrial development and business generally, and secondly to the relatively prosperous state of agriculture due to good seasons and greater demand overseas. Neverthless, and in view of unstable world conditions, South Africa may have to face a setback sooner or later and caution will continue to be the keynote of the railway administration's financial policy. Referring to the congestion which in the latter half of the financial period and well into the current calendar year taxed the resources of the railways to the utmost, the General Manager enters into a full explanation of the unparalleled and unforeseen flow of traffic and the measures which were taken to deal with it. He expressed his appreciation of the patience displayed by the public during the serious delays which occurred and also pays tribute to the press for giving publicity to the real reasons for the congestion and the steps taken to deal with it. The administration's staff responded loyally to the onerous demands made upon it.

As regards the results of working of the railways only, earnings increased, as compared with 1935-36, by £1,842,937, or 6·13 per cent., while gross working expenditure was higher by £936,244, or 4·76 per cent. The number of passenger journeys exceeded that of the previous year by 6,695,163, and revenue-earning goods and minerals reached the exceptional figure of 27,074,187 tons, an increase of 826,285 over the record tonnage of the previous period. The gross earnings also represented a new record for the system, exceeding the prevous highest total by £1,842,937. Interest charges on railway capital

XUM

were reduced from £5,120,633 to £5,052,155, and the surplus of earnings over gross working expenditure was equal to a return on capital of £7 9s. 9d. per cent. against £7 1s. 11d. in the previous period. Statistical and other figures relating to the railway transportation service compare as follow:—

	1936-37	1935-36
Passenger journeys	96,496,033	89,800,870
Goods and minerals, tons	17,461,986	16,725,608
Coal traffic, tons	9,612,201	9,522,294
Ton miles (revenue earning)	5,774,668,688	5,630,018,104
Average haul, miles	211	212
Route miles, open	13,263	13,239
Operating ratio, per cent.	64·57	65·42
	£	£
Capital expenditure (open lines)	153,807,469	151,234,778
Passenger receipts	5,768,878	5,209,538
Goods and mineral receipts	20,033,340	18,955,143
Coal traffic receipts	3,739,468	3,613,936
Total earnings	31,892,791	30,049,854
Working expenditure	18,501,060	17,613,215
Gross working expenditure (including depreciation)	20,593,860	19,657,616
Surplus over expenditure	11,298,931	10,392,238
Surplus over interest, &c.	6,464,021	5,623,158

On harbours there was a gross surplus of £1,206,208, and a net surplus, after meeting interest on capital, of £677,414, against £538,728, but on steamships there was a net loss of £2,749. Airways also showed a net loss of £68,001. New works in progress and the acquisition of new and additional rolling stock will involve an estimated expenditure of £26,308,957 over and above the £17,557,633 actually spent since 1933. Of this total of £43,866,590 approximately £20,100,000 is required for rolling stock, £16,400,000 on new works on open lines, and £4,200,000 on harbour improvements. One of the major improvement schemes, viz. electrification of the lines in the Witwatersrand area, as well as the Germiston-Pretoria line, will be completed early in the new year. With this and other improvements the administration's resources will be such that it will be able to cope with any traffic situation that may arise in future. On the subject of accidents the report refers to the prominence given to mishaps involving loss of life on the railways, while a far larger death roll on the roads is allowed to pass unnoticed. In point of fact the records show that during one year alone (1936) road accidents were responsible for more than three times the number of the persons killed in railway accidents during the whole period of 27 years since Union. As regards road competition, the process of co-ordinating the principal forms of transport in South Africa has now reached a stage where it can be said that a large measure of security and stability has been attained. Finally the report refers to electrification, the development of which is still proceeding. The total of electrified lines now working is 491 miles, equivalent to 905 miles of single track, while 69 miles, equal to 159 miles of single track, are under construction.

* * * *

Electrification Prospects in 1888

EXACTLY fifty years ago the motive power of underground railways was a very live topic, as there was an urgent demand for new railways to relieve urban congestion, and it was generally appreciated that steam traction had severe limitations even for shallow subway lines and was completely impossible for deep level railways. The report of the Metropolitan Railway at this time recorded that negotiations with the Electric Traction Company had enabled the Metropolitan directors to conclude an arrangement whereby the Electric Traction Company had undertaken to build at its own expense a locomotive of the same power as the existing Metropolitan steam locomotives, and that it should be run experimentally upon a section of the line outside the Inner Circle. It was further agreed that should the experiment prove completely satisfactory, the Electric Traction Company was to have the option of working the Metropolitan Railway by electricity for a term of five years at an agreed rate per train mile not in excess of the cost of working by steam locomotives. The subject was raised at the half-yearly meeting of the Metropolitan Railway on January 27, when Sir Edward Watkin, the Chairman, said that the company was doing its best to assist in the experiment. A few weeks later *The Railway Times* referred to the persistent rumours of a revolution in the world of electric traction, and said that what was but recently deemed the impossible was now spoken of with some degree of certainty owing to results which had grown out of practical experiments. It was then revealed that the electric unit in mind was an improved battery locomotive, and, of course, the experience from the past half-century has failed to justify the title which our predecessor gave its leader, namely, "The motor of the future."

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The Metallurgy of a High-Speed Locomotive

WE begin publication, on pages 303-311 of this issue, of an authoritative article dealing, from the metallurgical point of view, with the design and construction of the streamlined 4-6-2 express locomotives built at the Crewe works of the London Midland & Scottish Railway during 1937. This information, which, by Mr. Stanier's courtesy and co-operation, we are now able to place at the disposal of our readers, is supplementary to that afforded by the fully illustrated article appearing in our issue of May, 28, 1937, in which the first of the new engines, No. 6220 *Coronation*, then just completed at Crewe, was described in detail. The new series of locomotives was introduced for working the company's accelerated express passenger services between London and Glasgow, in accordance with a schedule demanding an average speed throughout of slightly over 62½ m.p.h. This, considering the distance, characteristics of the route, weather, and other factors, represents a fairly formidable task for the locomotives concerned. The reputation of British locomotive practice, alike in respect of design, materials and workmanship, is acknowledged by those competent to judge to be an enviable one, and the high standard thus indicated is never more necessary or desirable, than where a popular, time-saving service such as that of the Coronation Scot trains of the L.M.S.R. is offered to the public, for then success depends largely upon reliability, without which the attainment of uniform punctuality is impossible.

In spite of the foregoing, and although the "Princess Coronation" locomotives are the first streamlined express engines on the L.M.S.R., and specially intended for high-speed service, no very great departure from current practice in respect of materials was found necessary. At the same time, previously untried and experimental materials were not utilised, and no material was built into the engine which had not already been incorporated in some form on other modern locomotives belonging to the same railway. On the other hand, the design of so powerful an engine within the allowable axleweights was not achieved without very particular thought being given to the metallurgical side, even within the limitations imposed. The problem thus resolved itself into one of restricting as much as possible any unavoidable weight increase as compared with the previous 4-6-2 type locomotives, and so designing and constructing the engine that in spite of the con-

siderable and sustained demands made upon it, it should at all times be equal to its task, and able, therefore, to maintain the reputation of the service in respect of speed and punctuality.

The articles now published make it clear that nothing has been left undone to ensure that only the best and most suitable materials should be built into the engines. The analyses and tests, of which details are given both in the text of the article and in the tables accompanying it, provide excellent testimony to this fact, and although in some respects the engine is larger and more powerful than its predecessors, and has to carry the additional weight of the streamlined casings, it is only a few tons heavier than the engines of the " Princess Royal " class. This has resulted from a combination of careful design, and a reduction in the weight of certain materials and components, made possible in part by the use of special steels and other similar means, specialised machining methods to limit gauges, highly skilled and closely inspected work in the fitting and erecting shops, and in short, by resorting to all that is best in modern locomotive building operations.

By using special steels, a saving of over two tons was secured in the construction of the boiler shell and firebox; the connecting rods, 11 ft. 0 in. long as compared with the 9 ft. 0 in. of the previous engines, are each, in spite of their extra length, 7 lb. lighter than the shorter type. The weight per cylinder of the inside reciprocating parts on the *Coronation* engine, is 640 lb. including 40 per cent. of the inside connecting rod weight, as against 715 lb. in the *Princess Royal,* and although this is due in large measure to the absence of inside valve gearing and parts attached to the crosshead, it is also affected by the introduction of lighter inside rods made of special steel and of fluted section. In the case of the coupling rods, a saving of 412 lb. on the four rods was obtained compared with the previous engine, and to sum up the effect of using the special material and modifying the design, it may be stated that a total saving in weight of approximately 1,000 lb. was obtained in the reciprocating and revolving parts of the engine. The steel used gives a breaking strength of 50-60 tons per sq. in., with an elongation of 20-25 per cent., and a value of over 40 lb. in the Izod impact test. Nearly half-a-ton weight was saved by boring out the six axles of the locomotive; and by modifying the design of the piston valves to permit the use of a lighter section than usual, a saving of 96 lb. for the four sets of valves was effected. The various savings in weight which have been indicated total over five tons, and as the locomotive is up to the limit of weight at present allowed by the company's engineering department, unless this saving had been possible a very considerable reduction in the size of the boiler and capacity of the engine would have been necessary.

LETTERS TO THE EDITOR

(*The Editor is not responsible for the opinions of correspondents*)

The Gölsdorf Family

56, St. Germans Road, S.E.23
January 5

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I read with great interest the editorial article on the Austrian steam railway centenary in your issue of November 26, 1937, in which you gave some particulars relating to the well-known Gölsdorf family, whose members played such a prominent part in the development of the steam locomotive on the Continent. You remarked that Gölsdorf senior retired in 1900 and died three years later, as has also been stated in some German publications. There is, however, a statement in a leading Austrian journal to the effect that he died in 1911. It is possible that " 1900 " is a misprint for " 1909." Perhaps you can clear up this discrepancy and furnish some further details of the relationship between the various members of the family.

Yours faithfully,
T. S. LASCELLES

[We are grateful to our correspondent for calling attention to the discrepancies in the published accounts of the lives of the various members of the famous Gölsdorf family. We invited Dr.-Ing. Emerich Karner, Chief Mechanical Engineer of the Austrian Federal Railways, to assist us in settling the doubtful points, and he has replied as follows.—ED. *R.G.*]

Wien I, Schwarzenbergplatz 3
January 18

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I am in receipt of your letter of January 10. You will find in the following the dates of the Gölsdorf family. The father's name was Ludwig Adolf Gölsdorf. He was Chief Mechanical Engineer (*Maschinendirektor*) of the Südbahn-Gesellschaft and died in 1911, after having retired from service in 1909 (not 1900, as has sometimes been stated, presumably as the result of a misprint). He had two sons, Karl and Rudolf. The first was the well-known locomotive engineer, who died as Sektionschef of the k.k. Eisenbahnministerium in 1916. Rudolf, the second son of L. A. Gölsdorf, is a mechanical engineer and he is at the present time living in Vienna as Director of the Donau-Save Adria-Eisenbahngesellschaft, the successor of the former Südbahn-Gesellschaft. I hope this assists you in clearing up the whole question of the famous Gölsdorf family.

Yours faithfully,
E. KARNER
Maschinendirektor der Österr. Bundesbahnen

The G.W.R. London-Birmingham Service

The Deer Leap,
Westcott, Dorking
February 12

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The article on this subject in last week's issue is extremely interesting, and particularly so as indicating the opinion of the Great Western Railway Company that a non-stop schedule of 105 minutes between Paddington and Birmingham is feasible assuming a " King " class locomotive and a load not exceeding 300 tons tare.

As an example of the practicability of the timing, may I refer to a run timed by myself on the " Grand National " special train going north—the more difficult direction. The tare weight of the train was 329 tons (29 tons more than the suggested maximum), and the engine a " Castle " only and not a " King." The schedule was 110 minutes from Paddington to Birmingham (pass); but the train was seriously delayed by fog in its early stages, and passed High Wycombe 9½ minutes late. From here the point to point times were as follow, the suggested schedules on the 105 minutes booking being shown in brackets for comparison:—

High Wycombe–Princes Risborough, 9 min. 53 sec. (10 min);
Princes Risborough–Ashendon Junction, 6 min. 58 sec. (7½ min.);
Ashendon Junction–Aynho, 15 min. 50 sec. (16 min.);
Aynho–Banbury, 4 min. 32 sec. (4½ min.); and
Banbury–Leamington, 16 min. 08 sec. (16½ min.);

a total of 53 min. 21 sec. as against the suggested 54½ minutes. Another ¾ min. should be deducted from the actual times in respect of an engineering slack at Saunderton. On the up grade approaching that station before the slack speed rose to 55 m.p.h. (the suggested figure) with 28 per cent. cut-off, and the minimum up the 1 in 200 before

Ardley was 62·9, the average for the last 5 miles of the grade being 68·7, with 22 per cent. cut-off—full regulator in both cases.

Between Leamington and Birmingham a signal check near Widney Manor spoilt the comparison, but in any case I should be inclined to suggest that the 22 min. allowance for this stage would be the most difficult to observe.

With regard to service slacks, the list is impressive, but in practice their effect on times would not appear to be so serious as it might be. Those at High Wycombe and Leamington are a great handicap; but some (*e.g.*, those at Old Oak, West Wycombe, and Hatton for down trains) make comparatively little difference, having regard to the normal rate of speed at these points.

The gradients certainly call for some hard pulling; but the "½ mile at 1 in 45 approaching Snow Hill" is really a help, not a hindrance, since it assists quick stops or starts (as the case may be).

One cannot but feel that two 105-min. services in each direction, morning and evening, would meet a real and legitimate public need.

Yours faithfully,
HUMPHREY BAKER

58, rue de Courcelles, Paris
February 12

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I read with the greatest interest the article on the difficulties of the London-Birmingham G.W.R. route, appearing in the current issue of THE RAILWAY GAZETTE. Although it is somewhat preposterous for an outsider to judge problems of this nature, I suggest that the main point is the provision of locomotives having the highest ratio of power to weight, and the conditions outlined are almost ideal for the use of a four-cylinder compound 4-6-0, designed according to Mr. Chapelon's principles, on the lines of the remarkably successful 4-8-0's, class "240-700," of the former P.O. Railway. Such a locomotive, with 22 tons per driving axle, would be 50 per cent. more powerful than the present "King" class with approximately the same total weight.

Yours truly,
BARON G. VUILLET

[A difficulty in carrying out this suggestion lies in the limited width of the British loading gauge. With the large low-pressure inside cylinders of the Chapelon locomotives it is necessary to dish the driving wheels outwards at the centre, and this in turn would necessitate setting the outside high-pressure cylinders so far out as to foul our loading gauge.—ED. *R.G.*]

The Case for Final Amalgamation

25, Elvaston Place, Queen's Gate, S.W.7
February 4

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—When I wrote "Railway Amalgamation in Great Britain" in 1923, I said in my first paragraph that the Railways Act of 1921 represented the *penultimate* stage in the long process of amalgamation, complete unification being the obvious and logical goal. In my own mind, I gave the new companies ten years from 1924 to realise the results of amalgamation and to begin to grow "connective tissue." This has in fact happened, and I do not think one could have expected the process to have gone much farther than it has up to the present time without some powerful external stimulus. Road competition has done a good deal, but has not sufficed to give the final push. The L.P.T.B. has pointed the way on a metropolitan scale, and organisations like the Central Electricity Board, the B.B.C., &c., provide other examples of public bodies controlling definite services.

The railways must, I believe, inevitably take the same road, and whether the companies voluntarily go nine-tenths of the way or not, the final stage will have to be implemented by further legislation, since no Government can allow a complete railway monopoly to be achieved without some closer control in the public interest than is exercised at present over the Big Four. Whether that necessarily implies "purchase" by the exchange of National bonds for the present stocks and shares remains to be seen.

What does matter, however, is that the ultimate railway board should be essentially an expert transport body, representative of both management and labour (though also of the "consuming" public), evolved preferably from within the railway industry, and not something imposed arbitrarily from without. Remembering past experience in getting agreed schemes accepted by the Railways Amalgamation Tribunal as compared with the contentious Caledonian case, it would seem that the present companies would be wise to recognise betimes what is bound to come, and themselves prepare the way for its coming on lines that will ensure the greatest technical efficiency and therefore prove in the best interests of the public.

Yours faithfully,
W. E. SIMNETT

Locomotive Wheel Notation

Sentul, Kuala Lumpur,
Federated Malay States
January 19

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—With reference to the correspondence on wheel notation in THE RAILWAY GAZETTE, the use of a vertical stroke between adjacent but unconnected groups of driving or carrying wheels appears to meet the case satisfactorily. Thus:—

L.N.E.R., No. 10000 would be a 4-6-2/2.
Webb's *Greater Britain* on the L.N.W.R. would be a 2-2/2-2.
The new Baltimore and Ohio No. 5600 would be a 4-4/4-4.
Mallets would be a 2-8/8-2 &c.

This system becomes clumsy when dealing with the new trend of individual power units for each driving axle, in which case the type could be written "4-8-4 uncoupled." The above system has the advantage of including tenders if required, but I know of no system which would include some engines built, I think, for Turkey. These were of the 2-6-0 type with the addition of a carrying axle between the driving and trailing coupled axles. A diagram would appear to be the only solution.

Yours faithfully,
H. M. LE FLEMING

[We quite agree with our correspondent that some such system as he suggests could be devised to indicate various characteristics of a locomotive, and in certain foreign countries systems are in use which convey more information of particular types of locomotives than is possible with the ordinary Whyte system. The main drawback to any such scheme is that the Whyte principle is generally recognised, and any arrangement not universally understood would defeat its own object by being understood only in limited circles. The Whyte system certainly has its limitations, but it does convey the essential characteristics of locomotive wheel arrangement in a way which has become very widely recognised.—ED. *R.G.*]

SPEED IN VICTORIAN DAYS.—The report circulated by a London news agency of the presidential address given by Mr. Harry Bentham to the Society of Engineers, was widely quoted in the daily press on account of the statement that Queen Victoria had once travelled by train at over 100 m.p.h. According to this report: "On one occasion the Great Western Railway conveyed Queen Victoria at such a speed that the officials would not allow the figures to be published lest the public should take serious alarm and exception to the hurtling through the air of royal personages at such incredible speeds. A few years later the speeds disclosed that over 100 m.p.h. had been recorded." The accuracy of this statement was naturally contested in a letter to *The Times* from Mr. G. P. Antrobus, and in a subsequent letter to the same paper, Mr. Bentham himself explained that the news agency report had telescoped two disconnected phrases in his address. He had not implied that the alleged 100-m.p.h. maximum of Victorian days was achieved on an occasion when the Queen herself was a traveller. By implication, he accepted the statement of the late Mr. C. Rous-Marten in *The Engineer* for his speeds exceeding 100 m.p.h., but even this contested record was not set up in Victorian days.

PUBLICATIONS RECEIVED

The Railwaymen's Wages Guide and Calculator. By Jno. Aitken. Second and Revised Edition. Published by S. B. Aitken, 16, Upland Road, Glasgow, W.4. 28 pp. Price 1s. 6d. net. —This booklet, which is not an official publication, sets out in concise form the scales of annual salaries, weekly wage rates, overtime, and other duties for which payment at enhanced rates is made, insurances, and a 48-hour weekly wage table in the form of a calculator. The purpose for which it has been compiled is to facilitate reference to the various documents pertaining to the compilation of paybills, as well as to simplify the checking of their income by the staffs of the various grades.

New Zealand Railways Illustrated. Issued by the Publicity Branch, N.Z. Railways. 12 in. × 9½ in. 84 pp. with no advertisements.—This collection of coloured illustrations of the beauty spots and other features of interest is the most remarkable publicity album produced by a railway administration that we have seen. It consists of no fewer than 80 full-page pictures, all in four colours, many of them depicting what must surely be some of the finest scenery in the world. A brief but comprehensive historical and geographical introduction is followed by a short description of the Government Railways, penned by Mr. G. H. Mackley, the General Manager. The first railway to be opened in the Dominion was a short line at Christchurch in 1863, the forerunner of the present 3,300 route-mile system, which forms a network over both North and South Islands. Apart from the wide variety of scenery forming the subject of the bulk of the coloured plates, there are a few of the latter devoted to purely railway subjects, such as both day and night views of The Limited, the North Island main trunk express, headed in each case by one of the well-known "K" class 4-8-4 locomotives, reproduced, apparently, from paintings by Mr. W. W. Stewart; also interiors of the latest first and second class coaches; one of the new railcars, *Matahourua*; an aerial view of Hut Valley workshops and railway colony (Wellington); coloured maps of the two islands—which, incidentally, form keys to the positions of the scenes in the colour plates, as the page numbers are shown on the maps; Wellington new stations by day and also floodlit; as well as several fine viaducts and trains amid typical scenery. Of the wealth of landscape and seascape colour plates, perhaps the most striking and beautiful are the two of Mount Cook, "the magic mirror of Lake Matherson," two of the Franz Josef Glacier, and some magnificent waterfalls. Two views of different geysers near Rotorua are also of exceptional interest. Altogether, the administration is to be congratulated on this fine production, the purpose of which, as Mr. Mackley states, "is to show how closely related are the scenic attractions of New Zealand to the National Transportation system."

Notes about Earlier Holidays.—The number of monthly return tickets (the principal type of reduced fare tickets used by holidaymakers) issued by the main-line railways during the month of June, is increased by 100 per cent. in the month of August, it is pointed out in a new publication, entitled "Notes about Earlier Holidays," issued by the British Railways' Press Office. Approximately, 20,000,000 extra passengers travel by train during August as compared with May or October. The average long-distance train has seats for 500 passengers, so that 40,000 extra trains are required to transport these additional travellers. The number of passenger journeys (excluding workmen and seasons) made over the main-line railways during the summer months of 1936 were: May, 48,417,000; June, 56,238,000; July, 60,359,000; *August*, 71,746,000; September, 51,744,000. Habit and custom, tradition, and the incidence of school holidays, are factors, it is stated, which have brought about this concentration during August, which throws a difficult task upon those whose labours are necessary to cater for the holidays of others. How great are these difficulties —some idea of these may be deduced from the above figures—and what may be done under existing conditions—at any rate to alleviate these increasing inconveniences to both parties, is ably set out in this booklet. Copies may be obtained from the office's new address—St. Ermin's (South Entrance), Caxton Street, Westminster, London, S.W.1.

Chemins de fer (Railways): 57th edition of the handbook with this title in the series *Agendas Dunod*, edited by Pierre Place, of the Central Railway Designs Office (O.C.E.M.). Paris, 6e: Dunod, 92, Rue Bonaparts. 5¾ in. × 3¾ in. 400 pages of text, with diagrams, tables, and a folding chart. Price 25 fr. plus 10 per cent. for foreign orders.—The handbooks with the general title of *Agendas Dunod* cover a wide range of subjects and many at least of them have been appearing annually for some years. They are of convenient size for the pocket and contain a great quantity of technical information of value to the professional man. Little change has been made from last year's edition beyond bringing certain tables up to date and incorporating the latest information on special matters. After some notes on the legislation affecting the old companies, now superseded by the unified national management, the establishment of new lines, with legal formalities, engineering works, and track are dealt with in some detail. These are followed by sections on the resistance of trains, calculation of the power of locomotives and the loads they can deal with, methods of estimating the principal dimensions, testing, and working out a typical design. The principal component parts of a locomotive are then discussed and the various means of improving overall efficiency, such as superheating, feed-water heating, compound working, and blast-pipe design, with notes on certain well-known special types of locomotive. There is a short section on railcars with a table showing those in service in France on July 1, 1937. Electrification is next discussed, with details of various systems, and then train-ferry services. The construction of rolling-stock is treated at some length. Traffic working, the new signal aspects, and the fixing of rates and fares conclude the main part of the text, after which come a number of statistical and mathematical tables. The volume is neatly produced with clear diagrams and attractively bound and should meet with the same success as its predecessors. We notice a number of typographical errors that might, with advantage, be corrected for the future.

Steel Forgings.—To demonstrate the specialised attention given to steel forgings, Steel, Peech & Tozer (a branch of the United Steel Companies Limited, 17, Westbourne Road, Sheffield) has published an illustrated handbook describing the forging process step by step as carried out in the company's works. Emphasis is laid upon the precautions taken in such matters as heat control and pouring of the ingot, and the whole sequence of operations is shown in a two-page diagram, with informative comments alongside. Steel, Peech & Tozer is constantly producing locomotive crank-axles (built-up or solid), carriage and wagon axles, connecting rods, levers, links, and similar forgings. The crank-axles have a reputation for long life, and the firm has records of having supplied such parts since 1890. This book is bound in stiff covers, which give it a permanence appropriate to the great amount of useful information it contains.

Selecting Electrodes for Welding. —Murex Welding Processes Limited, Ferry Lane Works, Forest Road, London, E.17, has published a guide to the selection of the right electrode for the various applications of electric arc welding. The prevailing practice being to classify electrodes merely by names or numbers which are no guide to their specific purpose, the information clearly tabulated in this booklet will be found a valuable aid to efficiency and satisfactory work. Applications of Murex electrodes are set out in a two-page table with the broad classifications of work shown in red in the left-hand column, as headings to a detailed list of structural, mechanical, railway, and shipbuilding jobs. The appropriate electrode is shown, and an index reference given to the page in the booklet where its working characteristics are described. General instructions for the use of Murex electrodes are given in an introductory page.

XUM

THE SCRAP HEAP

While digging on the L.M.S.R. branch line at St. John's station, Bedford, workmen recently discovered human bones. The station stands on the site of St. Leonard's Hospital, a religious institution suppressed by King Henry VIII.

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A siren which will shriek for six hours and can be heard for five miles is being installed on trucks to frighten off hijackers. It can be silenced by a combination known only to the driver and goes off if the truck is tampered with in any way. The equipment can also be installed in passenger cars.—*From "Fortune" (U.S.A.).*

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BI-LINGUAL RAILWAYMEN

Welsh-speaking railwaymen from the South and Central Wales district were sent by the L.M.S.R. to Edinburgh in order to help the big contingent of Welsh supporters travelling to Scotland for the Scotland *v.* Wales international Rugby match at Murrayfield on Saturday last, February 5. They helped to guide and direct the passengers through microphones and loudspeakers installed at Princes Street station, and were also in attendance at the barriers to give information and to act as interpreters where necessary.

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LINES WRITTEN WHILE WAITING FOR A KENT & EAST SUSSEX TRAIN TO START

With apologies to all sorts of people—Isaac Watts, W. Longfellow, T. Hood, G. K. Chesterton, and others

How doth the little Saddleback
Improve each sleepy hour,
A-shunting wagons forth and back
In Northiam's leafy bower.

From Robertsbridge, by Rolvenden
Unhurriedly she'll go
To Tenterden and Biddenden,
With measured beat and slow.

She never comes a wink too soon
Upon her leisured way,
But round about the hour of noon
We hear her whistle play.

The Saddleback, all polished bright,
I love with all my heart!
But must she wait about all night
Ere she decides to start?

Fools! For she also had her hour,
A long, long hour and hard;
Performing prodigies of power
With trucks in Nine Elms Yard!

[C. HAMILTON ELLIS]

* * *

COTS FOR INFANT TRAVELLERS

The experiment is being tried on the South African Railways of collapsible cots for infants. The difficulties experienced by parents travelling on trains with their infants have always been felt, and it appears that some special provision should be made to meet this. Three collapsible cots have been bought and are now being tried. The reports so far received have been most favourable, and consideration is now being given to the permanent adoption of the scheme.

"Guide to Bradshaw"

Many years ago *Bradshaw's Railway Guide* passed over the border line which separates a well-known public facility from a national institution, and as a national institution it claimed the attention of Mr. Punch and his staff of learned clerks.

Artfully, we would not say hypocritically, declaring himself "the champion of *Bradshaw*, and Guide to the Guide," in a series of consecutive articles appearing in his issues for July 29 to September 23, 1865, he gives us what we feel sure is from preface to sixth and last chapter an authoritative exposition of the art and craft of Bradshaw. In this treatise we have Bradshaw considered "politically, ecclesiastically, astronomically, mystically, and musically"—or as modern authors would no doubt write "Bradshaw—The Man." Thereafter we are entertained by—or should we say there is served up for our serious consideration?—"Bradshaw—His Book."

Starting with the index, our erudite guide to the guide says: "Observe the notice that heads the front page. *Look for Index pages* 1 *to* 15. Look for it by all means; but that's quite another affair from finding it. Note the sly but honest fellow doth not commit himself even in jest. In the first fifteen pages you may glean intelligence about a Rotary knife cleaner, a Turkey carpet, or a Crystal sewing machine, but nothing about an Index. Now that's one specimen of Bradshaw's fun. What is the result? You must be the most crusty fellow and ill-bred into the bargain, if you don't enjoy a hearty laugh at the neat way in which you've been *done*." To avoid this mishap we would have advised "When with Bradshaw ignore his Romans."

Urging us to trust implicitly his *protegé*, Mr. Punch warns us, "Once let a doubt in Bradshaw be confirmed and established, and in whom, in what shall we put our confidence? Once let

FOR [*here follows imperfect print, probably part of the fun*] PLACES ON PAGES 82 and 83, see page 24 (1)

LONDON, MOTTLEBORO', WAITINGHAM, STOPFORD, PICKLESWADE, DEPSTER, WAGTON, M'STER, WUMSLEY, COORT, BELLHAM, &c. N.W.

Gen. Man. (2) J. SMITH.] [*Supt. of Line*, JO. MILLER. *Assistant-Supt.*, GRIMALDI, Jun.

(1) *Don't pay any attention to this: a mere formal preamble.*

(2) Abbreviation for Gentlemanly Man. Very kind of BRADSHAW to insert this gratuitous testimonial to the excellence of his friend, J. SMITH.

Miles from	Fares from 1 cl.	2 cl	3 cl.	For Metropolitan Line, see page 25. (3)	(3) Don't pay any attention to this: it only goes into deep questions, and won't do you any good. 1, 2, 3 mrn.	1, 3, 3 gov.	1, 2 mrn.	1, 2, 3 mrn.	1, 2 aft.	1, 2 ex. mrn.	1, 2, 3 aft.
	..	..	..	Carryton Street Station	A	..	..	9·45	2 0	11 50	5 0
	0 6	0 4	0 2½	**London** (4)							
	0 5	0 3	0 1	(4) This is clear enough.							
1½	1 0	0 6	0 3								
4	4 0	2 0	1 0	Horbury		6 45	Felton Station.	10·0	3 10	..	6 50
10	9 0	3 6	1 8	Clay Green		6 50		10 15	4 0	..	
12½	15 0	7 0	3 0	Pigwaldsen		7 0		11·0	4 30	..	7 0
14	20 0	10 0	5 0	**Mottleboro' (86)**		Stop		11·15		..	7·10
20½	25 0	12 6	4 3	**Waitingham (24)**			2·55	11·30	Arrives at 5 on Saturdays.		
26	30 0	15 0	7 0	**Stopford (57)** .. arr		..	3·40	12 10		12·30	Does not run beyond St. Swithin's except on Saturdays.
				dep						.. ..	
30	35 0	17 6	9 3	Pickleswade .... arr		On Saturdays only.	1 30	12·30	Passengers for these Stations remain at Stopford all night.	.. ..	3rd class to Snailsborough.
				dep							
50½				arr							
60	40 0	20 0	10 0	Depster **88, 89**			2·10 3rd cl. to the north				
							3·0				
64½	45 0	27 6	12 3	St. Swithin's			3·15				8·10
69½	50 0	25 0	14 0	Little Withem **102, 30**			4·10				
—		30 0	15 6	**51, 79, 3**							
90½	63 0	31 6	15 3	Snailsborough		1 25					9 0
100	71 0	35 6	17 3	Medwystone **55, 66**		2·15	..			7·15	9 30
102	80 0	40 0	20 0	Finch **44**		8.	..			Gov.	10·0
120½	100 0	50 6	25 0	Migdale		3·	6 15				10·30
160	160 0	80 6	40 3	Wagton ..... arr		Takes up.	Limited Express Mail.				Extra Trains see p. 11
				dep							
180	170 0	90 0	45 5	Messford		4·	7 0	3 10		8·10	11 15
264	260 0	108 0	83 0	Nark **89, 90, 100, 99**	(94) (0)			3 45		8·15	12·0
273	210 0	105 0	46 0	M'ster ..... arr				4·0		2·10	12·30
				dep	1·45	Sundays excepted.		4·10		Thursdays only.	1·0
..	..	..	82 0	Wumsley **60, 46, 1, 10**	..		8·15				1·15
..	..	..	..	Coort	..		8·30				
					..						
					..						
					..						
..	..	..	..	Langton **11, 88**	12·30	3rd class only.	10·0	11·13	Change for Bellham.		Passengers only booked for London.
..	..	..	..	Pellertham	..		10·15			3 45	2·50
				Bellham ..	..		11·0			4·50	3·10
						Stops if required.					
					1	2 | 3	4				

[*Reproduced by permission of the proprietors of "Punch"*

Alleged specimen "leaf out of Bradshaw," from "Punch" of August 19, 1865

the discovery be made that in the statements contained in Bradshaw no trust can be reposed, and what abiding happiness will remain to us in life? To and fro we shall be drifting, from one station to another, from one informant to another, now clinging to this opinion, now holding on by that, at one time late for an early train, at another early for a late, dependent on ignorant officials, at the mercy of grasping porters, equally uncertain as to the moment for entering or leaving a compartment, we, with mental powers weakened, equanimity utterly overthrown, and physical capacities prematurely decayed, shall ultimately find ourselves harmlessly playing at Steam Engines on the green sward of Colney Hatch, or composing an Oratorio out of old Great Western timetables while wandering in the cloisters of secluded Hanwell."

Weaving with perfect ease in and out of the intricacies of the "Key," our instructor says on the subject of dotted lines, "The epithet alludes to their appearance from any elevated situation, as, for instance, from the top of St. Paul's . . . From such positions the railways appear mere dots, or we may more correctly say, "mere specs"—and disastrous specs, too, sometimes."

Considering the division of trains, Mr. Punch is eloquent." After considerable labour," he says, "we divide all trains into six classes; exclusive of their own internal divisions (alas!) of first, second, and third:—The 1st consists of those trains which start and arrive. The 2nd of such as do not start but arrive. The 3rd of such as *do* start but *do not* arrive. The 4th of the trains whose departures from the starting point is subsequent to their arrival at their destination. The 5th of those trains which, neither starting nor arriving, yet manage to call at several stations on their road. The 6th, which neither start nor arrive, but *run*."

The nearest approach we can find in the modern *Bradshaw* having any resemblance to Mr. Punch's leaf of "*Bradshaw*" is that for the West Highland line reproduced below.

* * *

INTERNATIONAL LANGUAGE

The *Journal de Rouen* of May 22, 1841, stated that the best understanding existed between the numerous English and French workmen employed on the Rouen and Paris railway, and added, "They have organised a kind of language which is neither English nor French, by means of which they are enabled to converse with each other."

* * *

Here's a riddle to end all riddles, and it may be the death of me, too. A train operated by a Norwegian engineer starts to New York from Albany just as a train with a drunken engineer leaves New York for Albany. There's only one track, no switches or sidings, yet the trains do not collide. Why? Because Norse is Norse and Souse is Souse and never the twain shall meet, and I've left town.—*John Chapman in the "New York Daily News."*

* * *

SYMBOLS FOR TUBE STATIONS

The London Passenger Transport Board is considering the possibility of distinguishing new stations by symbols making them readily identifiable without reference to the name. The new Highgate station, which will serve surface and tube trains, will probably be surmounted by a metal silhouette of Dick Whittington and his cat. Inquiries have shown that the George Hotel, Wanstead, is named not after one of the Royal Georges, but in honour of St. George, and the station of Wanstead will, therefore, probably incorporate some representation of St. George and the dragon.

* * *

THE BUFFER STOP

Like Omar I do eagerly frequent
A terminus with laudable intent;
To supplement my erudition's crop
And see a buffer stop.
And stop it does, but not the way I meant;
To my grave discontent
Each locomotive, with a nervous snort,
Halts some feet short.
Let me presume to offer my advice,
Simple and sound, and cheap at any price,
To railway potentates: it is that these
Adopt the practice of the old Chinese.
Those ancient pundits on the outer wall
The mouths of cannon painted to appal
Bloodthirsty ruffians of invading hordes,
Who might have tried to hurt them with their swords.
A pair of buffers limned upon a beam,
In light of my experience, would seem
As disconcerting to an engine's sense
At less expense.

[A. QUITZOW]

1001 L & N E

EDINBURGH, GLASGOW, CRAIGENDORAN, FORT WILLIAM, and MALLAIG.

Down. Week Days Sundays

Miles		mrn	mrn	mrn	mrn	aft	aft	aft	aft	E	S						
	810 London (King's Cross) dep	7Y40	..	8Y25	10Y25	1 r 5	..	..	4H45	..	7H40	7H25	..	..	..	..	..	..
	990 Edinburgh (W.) 992 n	4M30	..	6M25	9M5	11 0	..	..	1M55	..	4	3 4 29	..	..	..	..	..	..
—	Glasgow (Queen St.) dep	5 50	..	7 55	10 35	1 10	..	..	3 46	..	5	5 6 7	..	..	..	..	..	..
15¼	Dumbarton n	6*16	..	8 25	11 5	1 37	..	..	..	..	5	19 6 34	..	..	..	..	..	..
—	A Greenock (Princes Pr.) dep	..	..	8 40	11 5	1 35	..	..	1 35	..	4	20 4 20	..	..	..	..	..	..
—	A Craigendoran Pier arr.	..	..	8 55	11 20	1 50	..	..	1 50	..	4	35 4 35	..	..	..	..	..	..
22½	Craigendoran dep.	..	..	9 7	11 28	2 0	..	..	4 22	..	5	48 6 57	..	..	..	..	..	..
24¼	Helensburgh (Upper)	6*30	..	9 13	11 34	2 6	..	..	4 28	..	5	54 7 3	..	..	..	..	..	..
26¼	Rhu	..	..	9 18	11 39	2 11	..	..	4 33	..	5	59 7 8	..	..	..	..	..	..
29¼	Shandon	..	..	9 24	11 45	2 17	..	..	4 39	..	6	5 7 14	..	..	..	..	..	..
31¼	Garelochhead	..	..	9 30	11 53	2 25	..	..	4 47	..	6	13 7 20	..	..	..	..	..	..
33¼	Whistlefield	..	..	9 35	11 58	2 30	..	..	4 52	..	6	18 7 31	..	..	..	..	..	..
42¼	Arrochar & Tarbet (mond	7 5	..	9 56	12 19	2 50	..	..	5 13	..	6	39 7 52	..	..	..	..	..	..
50¼	Ardlui, for Head of Loch Lo	7 21	..	..	..	..	..	..	5 29	..	..	..	..	..	..	..	..	..
58¼	Crianlarich 794 arr.	7 41	..	..	..	..	..	..	5Y49	..	..	..	..	..	..	..	..	..
	dep.	7 46	..	..	..	..	..	..	5Y54	..	..	..	..	..	..	..	..	..
63¼	Tyndrum	7 58	..	..	..	..	..	..	6 6	..	..	..	..	..	..	..	..	..
71¼	Bridge of Orchy	8 13	..	..	..	..	..	..	6 23	..	..	..	..	..	..	..	..	..
87	Rannoch C	8 41	..	..	..	..	..	..	6 51	..	..	..	..	..	..	..	..	..
94¼	Corrour	8 56	..	..	..	..	..	..	7 8	..	..	..	..	..	..	..	..	..
104¼	Tulloch D	9 17	..	..	..	..	..	..	7 28	..	..	..	..	..	..	..	..	..
110	Roy Bridge	9 29	..	..	..	..	..	..	7 40	..	..	..	..	..	..	..	..	..
113¼	Spean Bridge	9 37	..	..	..	..	..	..	7 48	..	..	..	..	..	..	..	..	..
122¼	Fort William F	10 n 7	..	..	..	4 50	5 0	..	8 30	..	..	..	..	..	..	..	..	..
125	Banavie	10 14	..	..	..	4 57	5 7	..	8 37	..	..	..	..	..	..	..	..	..
126¼	Corpach	10 18	..	..	..	5 1	5 10	..	8 41	..	..	..	..	..	..	..	..	..
132¼	Locheilside 1132	10 30	..	..	..	5 13	..	..	8 53	..	..	..	..	..	..	..	..	..
139¼	Glenfinnan, for Loch Shiel *	10 44	..	..	..	5 27	..	..	9 7	..	..	..	..	..	..	..	..	..
148¼	Lochailort	11 5	..	..	..	5 48	..	..	9 28	..	..	..	..	..	..	..	..	..
157	Arisaig	11 24	..	..	..	6 7	..	..	9 47	..	..	..	..	..	..	..	..	..
161¼	Morar	11 38	..	..	..	6 21	..	..	10 1	..	..	..	..	..	..	..	..	..
164¼	Mallaig arr.	11 45	..	..	..	6 28	..	..	10 8	..	..	..	..	..	..	..	..	..

Up. Week Days Sundays

Miles		mrn	mrn	mrn	mrn	aft	aft	aft	aft	aft	aft	aft	aft	aft	aft	aft	aft	aft
	Mallaig dep.	6 35	..	..	8 35	..	..	..	12 5	..	..	..	2 15	..	..	..	..	..
2¼	Morar	6 45	..	..	..	..	..	..	..	..	..	..	2 24	..	..	..	..	..
7¼	Arisaig	7 0	..	..	8Y54	..	..	..	12Y24	..	..	..	2 37	..	..	..	..	..
15¼	Lochailort 1132	7 23	..	..	9M11	..	..	..	12 42 Z	..	..	..	2 56	..	..	..	..	..
24¼	Glenfinnan, for Loch Shiel *	7 55	..	..	..	..	..	..	1 2	..	..	..	3 17	..	..	..	..	..
31¼	Lochailside	8 15	..	..	..	..	..	..	1 16	..	..	..	3 31	..	..	..	..	..
38	Corpach	8 34	..	..	..	..	..	..	1 28	..	..	..	3 43	5 20	..	..	..	..
39¼	Banavie	8 40	..	..	..	..	..	..	..	..	..	..	3 47	5 24	..	..	..	..
41¼	Fort William F	8 50	..	..	10 n 3	..	..	..	1 43	..	..	..	4 4	5 31	..	..	..	..
51	Spean Bridge	..	..	..	10 21	..	..	..	2 1	..	..	..	4 23	..	..	..	..	..
54¼	Roy Bridge	..	..	..	10 28	..	..	..	2 8	..	..	..	4 30	..	..	..	..	..
60	Tulloch D	..	..	..	10 43	..	..	..	2 22	..	..	..	4 45	..	..	..	..	..
70	Corrour	..	..	..	11 6	..	..	..	2 45	..	..	..	5 8	..	..	..	..	..
77¼	Rannoch C	..	..	..	11 20	..	..	..	2 58	..	..	..	5 22	..	..	..	..	..
92¼	Bridge of Orchy	..	..	..	11 46	..	..	..	3 21	..	..	..	5 49	..	..	..	..	..
100¼	Tyndrum	..	..	..	12 2	..	..	..	..	..	..	..	6 6	..	..	..	..	..
105¼	Crianlarich 794 arr.	..	..	..	12Q11	..	..	..	3Y44	..	..	..	6 17	..	..	..	..	..
	dep.	..	..	..	12Q16	..	..	..	3Y49	..	..	..	6 24	..	..	..	..	..
114	Ardlui, for Head of Loch Lo	..	..	..	12 34	..	..	..	..	..	..	..	6 43	..	..	..	..	..
122	Arrochar & Tarbet (mond	7 25	10 3	..	12 50	..	1 52	52	4 23	5 32	..	..	7 0	..	..	..	..	..
131	Whistlefield	7 46	10 24	..	..	..	2 13	13	..	5 53	..	..	7 21	..	..	..	..	..
138¼	Garelochhead	7 52	10 28	..	1 14	..	1 30	17	4 46	5 57	..	..	7 25	..	..	..	..	..
135	Shandon	7 58	10 34	..	..	..	1 36	23	..	6 3	..	..	7 31	..	..	..	..	..
137¼	Rhu	8 4	10 40	..	..	..	1 42	29	..	6 9	..	..	..	..	..	..	..	..
139¼	Helensburgh (Upper)	8 9	10 45	..	1 29	..	1 47	34	..	6 14	..	..	7 42	..	..	..	..	..
141¼	Craigendoran arr.	8 13	10 49	..	1 33	..	1 51	38	5	3 6 18	..	..	7 46	..	..	..	..	..
—	A Craigendoran Pier dep.	8 20	1 15	..	..	..	3 50	50	..	..	..	..	..	..	..	..	..	..
145¼	A Greenock (Princes Pr.) ar	8 35	1 30	..	d	..	4 5	5	..	..	..	..	d	..	..	..	..	..
149	Dumbarton 778 arr.	8 30	11 20	..	..	..	2 25	4 13	..	6 44	..	..	..	..	..	..	..	..
164¼	Glasgow (Queen St.) n	8 57	1150	..	2 13	..	3 6	4 45	5 42	7 18	..	..	8 27	..	..	..	..	..
211¼	990 Edinburgh (W.) 992 arr.	11 6	1 25	..	3 19	..	5 06	4	7 58	58	..	..	9 35	..	..	..	..	..
604¼	817 London (King's Cross) n	7 59	35	..	3 15	..	5 15	5	7 15	..	..	..	7 15	..	..	..	..	..

A By Steamer. A Calls at Arisaig on Tues., Thurs., & Sats., and at Lochailort on Mons. Weds., & Fris. when required to take up. C To Tighnalinn—West end of Loch Rannoch—54 miles. Q Except on Sats. passengers can arr. 10 30 aft. by the "Coronation," dep Edinburgh 4 30 aft. (supplementary charges). Limited accommodation. a Arr. 1 38 aft. D Station for Loch Laggan Hotel (East end of Loch), 12¼ miles. d Calls at Cowlairs at 2 5, & 8 19 aft. respectively. d Arr. 3 5 aft. E or £ Except Sats. F Sats. for Ballachulish (Glencoe) & Kinlochleven. J Stops when required to set down from Glasgow or South or East thereof on notice being given to Station Masters at Queen Street or Cowlairs. K Luncheon Baskets can be obtained at Crianlarich. N Morn. time. O Arr 1 13 aft Sats. R Restaurant Car between Glasgow and Mallaig. S Passengers for stations north of Arrochar and Tarbet dep Edinburgh 2 55 aft. Change at Cowlairs. Passengers must notify Station Master, Edinburgh, when stop at Cowlairs is required. RC Restaurant Car S or $ Sats. only SC 1st & 3rd class Sleeping accommodation T Pullman Cars only. 1st & 3rd class. Extra charge TC Third Carr. u Arr. 9 54 mrn. V Night time. Applies Week days (except Sats.) & Suns. v Arr. 10 0 mrn. X Passengers arriving King's Cross in Sleeping Cars may remain in Cars until 8 0 mrn. Y Tea Baskets may be obtained. Z Stops when required. Passengers give notice at Station 10 mins. before train is due.

* Stops when required to set down from England or when required to take up for Arrochar & Tarbet or beyond. Passengers joining the train must be at Station at least 10 mins before dep. time † Tea and Biscuits obtainable on Train.

LOCAL TRAINS and Intermediate Stations between Glasgow and Craigendoran, see page 998.
OTHER TRAINS between Crianlarich and Tyndrum, page 794. * For Loch Shiel Steamers, page 1132.

A page from the current "Bradshaw", showing the winter service on the West Highland line

XUM

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Railway Service Conditions to be Discussed

The 15th half-yearly meeting between the Railway Board and the All-India Railwaymen's Federation was held at New Delhi on January 26 and 27. The subjects for discussion included:—

(1) Revised scales of pay for journeymen and chargemen on State-managed railways.
(2) The policy regarding the recovery of alleged over-payments to staff on State-managed railways.
(3) Procedure to be adopted in respect of alleged breaches of the accepted policy of State-managed railway administrations.
(4) Working of the Payment of Wages Act.
(5) Accumulation of leave for inferior service staff on State-managed railways.
(6) Conciliation and railway trades disputes on State-managed lines.

Bamrauli Collision

[The following further details with regard to the collision at Bamrauli station, E.I.R., on January 16, reported briefly on page 226 of our issue of February 4, have now been received from our correspondent.—ED., *R.G.*] After leaving Allahabad the express was to have run through Bamrauli—which is alongside Allahabad aerodrome—on the loop line, but for some unexplained reason it was admitted on the platform line where the goods train was standing. The first three coaches of the express were telescoped and reduced to matchwood, and the six leading wagons of the goods train were destroyed and flung on to the loop line.

New Stock for the Flying Ranee

The ever-increasing popularity of the B.B. & C.I.R. Flying Ranee express has induced the administration of that line to build new coaching stock for it, embodying several new features. The third class carriages are provided with corridors and a third class restaurant car is included with separate accommodation for Hindus and Mahomedans. Another novelty is the provision of a second class observation car fitted with comfortable tip-up seats. The new train is also equipped with a telephone, so that passengers can speak to their friends until the moment of departure from Bombay. An inaugural run of the new train will take place on January 29. In spite of these added amenities the fares still remain at 1½ single fares for the week-end return for men, and at single fare for ladies. The observation car will be on view at Bombay Central from January 24.

Wedgwood Report Discussions

It will be recalled that the Government of India agreed, during the discussion of the Wedgwood Report in the Council of State, to allow time for further discussion of the report during the Budget session. It is understood that the special officers who have been entrusted with the work of examining in detail the recommendations of the committee have drawn up an exhaustive report on the action already taken or about to be taken in the near future on these recommendations. This report will be laid on the table in the forthcoming session of the Central Legislature.

Railway Enterprise in Political Conference

The decision in recent years of the Indian National Congress to hold its annual session in villages instead of in cities, has brought into prominence certain small stations, which have been the centre of brisk activity on the part of the railways to meet the exceptional traffic of delegates and visitors. Last year a small station on the G.I.P.R., Savda, suddenly loomed into importance on account of the Faizpur Congress, and this year the B.B. & C.I.R. administration is called upon to make extensive additions and alterations at another small station, Kim, to facilitate the handling of the large passenger traffic in connection with the forthcoming session of Congress. It is understood that the railway company is spending more than Rs. 1 lakh at Kim for the Congress session.

ARGENTINA

New State Railways Branch

A Government Decree, issued on January 18, authorises the construction of a branch of the State Railways from Paraná to Maria Grande in the Province of Entre Rios, a distance of some 50 km., at an estimated cost of $3,500,000 paper. The work will be entrusted to the contractor for the La Paz-Feliciano-San Jaime branch in the same province, to which the proposed new line is intended to be complementary.

Exemption of Railways from Municipal Taxation: Important Legal Decision

An important ruling, confirming the exemption from municipal taxation granted to the railways by Laws Nos. 5315 (Mitre Law) and 10657, has been given by the Appeal Court of the central zone of the Province of Buenos Aires, in a legal action brought against the Central Argentine Railway by the municipality of San Antonio de Areco, in respect of lighting, street cleaning, and water taxes. The judge who tried the case in the first instance pronounced judgment in favour of the company, and his decision has now been confirmed by the Appeal Court, thus settling a matter which, for some time past, has been the subject of much discussion in the courts. The municipality appealed against the verdict of the lower court on the grounds that the laws mentioned were unconstitutional; but the Appeal Court, after a careful study of all the circumstances, unanimously decided in favour of the railway, accepting the constitutional validity of the laws granting the companies exemption from national, provincial and municipal taxation in exchange for a contribution of 3 per cent. of their net receipts to the national exchequer.

S. American Locomotive Engineers

The fourth quarterly meeting of the South American centre of the Institution of Locomotive Engineers was held in Buenos Aires on December 17, the Chairman, Mr. F. Campbell, presiding. Five papers were submitted under *noms-de-plume* by associate and graduate members of the institution, dealing with the following subjects: "The possibilities of tare weight reduction in wagon stock"; "Locomotive cylinder designs"; "An outline of the general tendency of modern passenger rolling stock"; "Diesel railcars"; and "The trend of passenger rolling stock design."

The quarterly session was followed by the annual meeting, presided over by Mr. Campbell, who reviewed the work of the past year, which he said had been a most satisfactory one.

International Rail and Road Bridge between Argentina and Brazil

The scheme for the construction of an international rail and road bridge over the River Uruguay between Paso de los Libres (in the Argentine province of Corrientes) and Uruguayana (Brazil) —see THE RAILWAY GAZETTE of August 10, 1934—was officially inaugurated on Sunday, January 9, when a commemorative monolith was unveiled at both points named by the respective Presidents of Argentina and Brazil, General Agustin P. Justo and Dr. Getulio Vargas. The bridge will have a total length of 1,380 m., comprising 38 central spans of 35 m., and two terminal spans of 25 m. There will also be a supplementary bridge, 100 m. long, over the marshy approaches to the Argentine side of the river, where there is danger of flooding. In addition to a paved roadway 6 m. wide, there will be space for railway lines as well as for pedestrian traffic. The cost of the work is estimated at, approximately, $5,000,000 Argentine paper, to be defrayed in equal proportions by each country concerned. Tenders will be called for publicly in March this year. The work is expected to occupy two years.

Quarterly Statistics

The return of the *Instituto de Estudios Economicos* for the first three months of the financial year 1937-38, for the privately-owned railways of Argentina, shows in the aggregate figures a small increase in gross earnings and a rather larger increase in working expenses. Gross receipts were $108,231,000, against $107,897,000 for the corresponding period of 1936-37; while in expenses $87,866,000 compared with $83,736,000, so that net earnings were lower by 15·7 per cent. at

$20,365,000, as against $24,161,000, losses in exchange excluded.

Passenger receipts were $20,116,000 against $19,398,000; and goods receipts $77,490,000, against $77,208,000. In numbers 37,479,000 passengers were carried and 10,797,000 tons of goods, compared with 34,693,000 passengers and 10,785,000 tons in the same period of 1936-37.

CHILE

Proposed Branch Line between Santiago and Los Andes

The decision of the Argentine Government to rebuild the damaged portion of the Transandine Railway has revived a proposal for the construction of a short branch line to connect Los Andes directly with Santiago, in order to obviate the inconvenience at present caused to Transandine travellers to and from the last-mentioned city by having to change at Las Vegas, the junction between Santiago and Valparaiso.

Funds for Railway Construction

According to information from Santiago, the Direction of Public Works has asked the Ministry of Development to authorise a grant of $15,800,000 Chilean pesos (approximately £124,400 sterling) to be expended on various railway construction schemes, including the continuation of the line from Antofagasta to Socompa and that via Lonquimay. (Present rate of exchange: 127 Chilenos to the pound.)

EIRE

Guaranteed Excursions

For some years past a prominent Dublin drapery and general store guaranteed excursion trains to Dublin, and refunded the cost of the railway ticket to any purchaser of £5 worth of goods in the store in question. These excursions proved a success, and the railway company, by reason of the guarantee, was assured that the special trains would give a reasonable return. The arrangements were lavishly advertised in the daily press, and opportunity was taken at the same time to advertise the wares for sale.

A progressive competing firm, wishing to benefit from the same kind of business, also guaranteed special trains and lodged a cash guarantee in each case, but the receipts from these trains did not reach the sum guaranteed and the company had to retain the deficit out of the amount lodged. Undeterred by the failure on the first few occasions this second firm subsequently guaranteed a special train from Cavan to Dublin on January 6 and this train was duly advertised. On the same date other excursions from different sections of the line were also organised by the initiators, but to the astonishment of all concerned only one passenger purchased a ticket by the train from Cavan; this surely must be a record of failure on behalf of train guarantors. Of course, the railway company suffered no loss, having secured beforehand the amount of the guarantee in cash.

In considering any proposal for extending shopping excursions, consideration must be given to the fact that traders in small towns are customers of the railway company, and if their local customers are drawn to the cities, the local trade is reduced and the carriage of goods thereby affected. For this reason any façilities given for shopping have to receive very careful consideration before being granted, and the possibilities of extension are threatened by possible conflict with local interests.

NEW ZEALAND

Staff Matters

During the depression period it was not possible for the Railways Department to place on the permanent staff apprentices who had completed their term of apprenticeship and had passed the qualifying examinations. Conditions have, however, now become more stabilised and a comprehensive review of the position has enabled 210 of these apprentices, who have been attached to the temporary staff, to be made permanent.

The Railways Department is the largest landlord in the Dominion, maintaining some 3,450 dwellings for the housing of its staff. The Minister of Railways has authorised the installation of hot water services in a number of departmental dwellings and a comprehensive programme in this connection is at present in hand.

In view of the very considerable increase in the work being undertaken in the various railway workshops, a review has recently been made of the permanent staff establishments, and arrangements are now in hand to absorb into the permanent staff a number of long-service employees who have hitherto been temporary.

CANADA

Re-sleepering during 1936

The following figures are included in a report of the American Railway Engineering Association as representing sleeper renewals on the three principal Canadian systems during 1936:—

System	Canadian National	C.P.R.	Temiskaming and Northern Ontario
Miles maintained	29,934	22,314	548
Untreated sleepers used	4,922,263	1,763,930	111,400
Average cost	55·6 cents	57 cents	69 cents
Treated sleepers used	2,333,590	1,814,577	3,156
Average cost	$1·259	$1·19	$1·89
Total sleepers used	7,255,853	3,577,507	114,556
Total sleepers maintained	85,702,575	63,153,392	1,556,800
Average sleepers per mile maintained ...	2,863	2,830	2,900
No. of renewals per mile	242	160	209
Ratio renewals, total	8·5	5·7	7·4

During the five years 1932-36 the average cost per year for sleeper renewals per mile maintained is shown as $160·04 for the C.N.R., $151 for the C.P.R., and $175·33 for the T. & N.O.

SWITZERLAND

1937 Results

Provisional figures just published by the Federal Railways for the year ended December 31, 1937, show that the increase in receipts over 1936 continued throughout the year, with the exception of November, when there was a slight decrease. Total receipts amounted to fr. 336·2 million, or 44·8 millions (13·3 per cent.) more than the previous year. Working expenses were reduced by fr. 484·000 and amounted to fr. 212·4 million. Net receipts were therefore fr. 123·8 million, representing an increase of 45·3 millions. The net charges of the profit and loss account, however, are estimated at fr. 146 million.

FRANCE

The Statutes of the National Railways Company

The statutes of the National Railways Company, which came into being at the beginning of the year, in accordance with the convention of August 31, 1937, were published in the *Journal Officiel* of January 7. The main provisions of the first part of the decree, which relates to upkeep and working, are the following:—

The Minister for Public Works, after consulting the Ministers for War, Marine and Air, may authorise the company to suppress any activities rendered unnecessary by changes in operation. He may fix, in the interests of safety and efficiency, the conditions to which locomotives, tenders and passenger coaches must conform.

The company must submit for the Minister's approval all proposed regulations and passenger timetables.

The Minister may authorise the company to reduce or to suspend services on any lines, or parts of lines, deemed to be no longer justified by traffic requirements. He may also authorise the company to arrange for any given services to be assured by other than railway transport.

As regards traffic rates, all proposals for changes must be posted up in stations for the general information of the public, and must also be communicated to chambers of commerce and chambers of agricul-

XUM

ture, a month beforehand. Subject to approval, the company may conclude with individuals or with groups, special agreements regarding rates for the conveyance of their goods. Such agreements, which must not be for more than a year at a time, must not have the effect of placing in a disadvantageous position other senders or receivers of goods similarly placed.

In the case of goods being carried in transit, the Minister may authorise the company to apply such tariffs and conditions as it may deem appropriate to meet competition from foreign transport services.

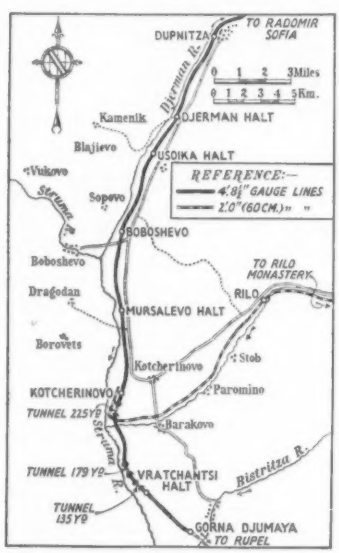
The company must be prepared to effect, or to organise through intermediaries, door-to-door collection and delivery within specified areas.

Other clauses provide for the conveyance of troops and of postal matter, the construction of new lines, and the construction of private sidings at the expense of those who wish for them. A subsequent decree will deal with the construction and operation of sidings at ports.

BULGARIA

The New Dupnitza—Gorna Djumaya Railway

[On October 17, 1937, the new Dupnitza—Gorna Djumaya railway in South-western Bulgaria was opened for traffic, as recorded in the news section of our issue of October 22 last—ED. *R.G.*]. It forms a section of the important Sofia — Radomir — Dupnitza — Demirhissar route which links the Bulgarian capital with the Mediterranean at Salonica. The construction of the



22-mile line from Sofia to Radomir was taken in hand as far back as 1892, and in 1915 the construction of the extension from Radomir to Dupnitza—Gorna Djumaya was decided upon, but work upon it was suspended in 1916 owing to Bulgaria's entry in the war. During the latter year, however, the military authorities built a 2 ft. 0 in. gauge 97-mile railway from Radomir, through Gorna Djumaya as far south as Petrich, on the Greek frontier, exclusively for military purposes. This railway was also worked by the Ministry for War after the cessation of the hostilities, and was taken over by the Bulgarian State Railways only in 1919. Its operation proved so uneconomic, however, that for the nine years 1920-1928 a working deficit of no less than 102,521,000 leva (about £256,000 at par) had accrued, in spite of the fact that the traffic had risen from 182,881 passengers in 1920 to 338,526 in 1928, and goods from 54,371 English tons in 1920 to 162,534 tons. The growth in traffic was one of the reasons that prompted the Bulgarian State Railways to convert this line into a standard (4 ft. 8½ in.) gauge railway. Work was begun on the Radomir—Dupnitza section (26·5 miles) in May, 1925, and the new line was inaugurated on December 21, 1930; it cost 130,071,437 leva (about £325,178 at par).

Construction Details

The next section from Dupnitza to Gorna Djumaya was taken in hand in May, 1928. The construction of this 20·1-mile extension, which like the earlier one is single line, was delayed for financial reasons, but it also presented great technical difficulties especially in the narrow défilé at the northern end of the Struma valley.

As much as 38·12 per cent. of it is curved, the sharpest curve being of approximately 15-ch. radius; some 10·53 per cent. of the whole line consists of 15-ch. curves. The ruling gradient is 1 in 67, and there are 111 bridges, culverts, ducts and other minor works apart from three tunnels between Kotcherinovo and Vratchantzi stations, totalling 540 yd. in length. The line falls from Dupnitza, 1,595 ft. above sea-level, to Gorna Djumaya which is 1,191 ft. in altitude. The cost of construction totals 79,049,034 leva (£197,622 at par). From the station Kotcherinovo a décauville railway branches off, establishing a connection through the Rilska Valley, with Rilska and the most famous religious centre in Bulgaria, the Rilo Monastery.

An Important International Link

The principal object of the opening up of this standard gauge connection is to give Bulgaria a direct trunk connection with the Mediterranean. The gradual building of the railway Sofia—Gorna Djumaya, the eventual reconstruction and conversion of the narrow-gauge Gorna Djumaya—Petritch line, and the linking of Petrich with Demirhissar in Greece, on the line to Salonica are successive steps towards the realisation of this aim. Once the link Sofia—Salonica is established, it will not only constitute a vital link between Bulgaria and the Mediterranean, but will also constitute the shortest connection from the Danube to the Mediterranean. It is thus a trans-Balkan line of outstanding importance, and will to some extent compete with the other trans-Balkan railway now building: the Danube—Adriatic railway in Yugoslavia.

CHINA

Railways under Ministry of Communications

In consequence of war conditions, the Ministry of Railways has been closed down, and its duties absorbed by the Ministry of Communications, which, with other National Government departments, has been moved to Hankow. Portions of the Shanghai-Nanking, and Shanghai-Hangchow-Ningpo Railways have been temporarily restored by the military authorities and put into use by them in a limited degree, but they are not available for civil traffic in the areas under Japanese army occupation. Engines, rolling stock, and workshops have been very considerably damaged and rehabilitation will be a costly and difficult task. The former railway staffs are in many cases unemployed and scattered, and to re-assemble competent men in both administrative and technical branches will take time. The extensive repairs to engines, rolling stock, buildings and track will require competent labour and considerable time, and operating can be restored only gradually.

NORWAY

Recent Years' Results of Working

Since the depths of the depression in the years 1930-31-32, the traffic and financial results of the State Railways have shown a steady upward trend; they are, however, still far below those of the peak year 1919-20. This statement is borne out by the following table, giving the results for the last pre-war year, the peak year, and for the 1930-36 period.

Year Ended June 30	Route-Mileage Worked	Passengers Carried (Millions)	Goods Carried (Million Tons)		Financial Results (Million Kroner)			Corresponding Percentage on Capital	Capital at Charge (Million Kroner)
			(a)	(b)	Receipts	Expenditure	Profit or Loss		
1914	1,707	17·9	3·6	3·4	31·5	26·7	+ 4·8	+ 1·56	307·2
1920	1,782	31·4	4·8	1·0	114·8	117·4	− 2·6	− 0·56	384·4
1931	2,179	17·3	3·8	4·0	71·6	78·4	− 6·8	− 0·79	866·4
1932	2,179	18·0	3·7	1·9	64·5	75·8	−11·3	− 1·30	869·8
1933	2,179	18·5	3·8	1·3	64·3	71·7	− 7·4	− 0·85	867·9
1934	2,179	17·5	3·9	1·3	66·3	68·5	− 2·1	− 0·25	869·5
1935	2,214	17·6	4·2	3·5	68·4	70·3	− 1·9	− 0·21	905·5
1936	2,250	19·3	4·2	4·7	71·9	73·8	− 1·9	− 0·20	931·3

(*a*) Exclusive of the Ofoten Railway (between Vassijaure and Narvik) which carries practically nothing but ore from Sweden. (*b*) Ofoten Railway traffic only.

THE METALLURGY OF A HIGH-SPEED LOCOMOTIVE—I

A survey of the materials used in the construction of the streamlined express engines of the L.M.S.R. with details of analyses and tests

IN THE RAILWAY GAZETTE of May 28, 1937, we published an article illustrating and describing the first of the 4-6-2 streamlined express locomotives of the London Midland & Scottish Railway, No. 6220, *Coronation*. Five engines, known officially as the "Princess Coronation" class, were built in 1937 at the company's works at Crewe in accordance with this design, the others of which were numbered and named, 6221, *Queen Elizabeth*; 6222, *Queen Mary*; 6223, *Princess Alice*; and 6224, *Princess Alexandra*. As was then stated, the new locomotives represent a development of the earlier 4-6-2 engines of the "Princess Royal" type, but in addition to being provided with streamlining, the boiler is of considerably greater capacity, while certain improvements have been made to the frames and valve motion.

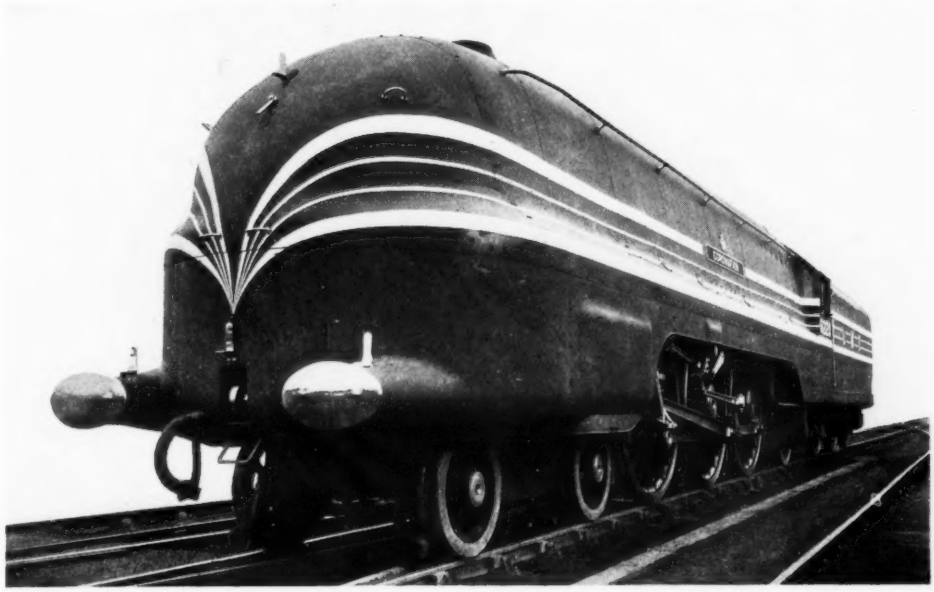
The form of streamlining adopted was finally decided after very careful experiments with models in the L.M.S.R. Research Department's wind tunnel at Derby, where tests were carried out to represent both head winds and winds crossing the tracks at various angles.

The following are the principal particulars:—

Cylinders (4), dia. × stroke	16½ in. × 28 in.
Valve gear	Walschaerts (2 sets)
Valve travel	7⅛ in.
Coupled wheels, dia.	6 ft. 9 in.
Boiler—	
Working pressure	250 lb. per sq. in.
Firebox heating surface	230 sq. ft.
Tube heating surface	2,577 ,,
Total (evaporative)	2,807 ,,
Superheater	856 ,,
Combined heating surface	3,663 ,,
Grate area	50 ,,
Tractive effort at 85 per cent. boiler pressure	40,000 lb.

These locomotives were specially constructed for working the L.M.S.R. accelerated 6½-hr. express services between Euston and Glasgow, with one stop, at Carlisle, in each direction. The distance is 401½ miles, giving an average speed, allowing for the stop at Carlisle, of 62·6 m.p.h. The engines have proved highly successful, and the percentage of punctual arrivals at each end has been uniformly high.

In view of the interest attaching to the locomotives, and the work they do, we formed the opinion that among the readers of THE RAILWAY GAZETTE both at home and abroad, there would be very many whose interest is not merely centred in the design and performance data of the type, but who would like to have information bearing upon the metallurgical side of the subject. This is a very important aspect of locomotive design, especially where engines are built to work at unusually high speeds for relatively long periods at a time, and under conditions in which complete reliability plays such an important part.



Streamlined 4-6-2 type express locomotive "Princess Coronation" class, L.M.S.R.

The *Coronation* locomotive, although ranking as the first streamlined express engine on the L.M.S.R., and being specially intended for high-speed service, is not actually one in which any very great departure has been made from current practice, so far as the materials of which it is constructed are concerned. In instituting so important a service as that of the Coronation Scot train, the first and essential requisite of the locomotive was that already referred to—namely, complete reliability. For this reason, previously untried and experimental materials were not used, and no material has been built into the engine which has not already been incorporated in some form or other on modern locomotives of the L.M.S.R. From the purely metallurgical point of view, therefore, the engine may be said to embody all that is of true worth in the best modern

practice. On the other hand, the design of so powerful an engine within the allowable axle weights was not accomplished without very particular thought being given to the metallurgical side, even within the limitations above outlined; and by the courtesy of the company's Chief Mechanical Engineer, Mr. W. A. Stanier, we have been given access to sources of information and data regarding the problems that arose, and the means adopted to meet them.

The basis of the *Coronation* design was the already successful "Princess Royal" class of engine, the first of which was built at the L.M.S.R. Crewe works in 1933, and of which illustrated particulars were given in the issue of THE RAILWAY GAZETTE dated June 30, 1933. To meet the projected services embodying the high-speed runs between Euston and Glasgow, certain alterations were considered necessary, these consisting mainly of increased boiler capacity, larger coupled wheels, and the introduction of streamlining. The latter, on the ground that it would prevent ready access between the frames, suggested the elimination of the separate inside valve gears. A slight increase in cylinder diameter was called for, to maintain the same tractive effort with the larger coupled wheels, but at the same time the weight on these wheels—67 tons 10 cwt.—could not be exceeded.

Boiler Design and Materials

The boiler of the locomotive has a length of 19 ft. 3 in. between tubeplates, and is tapered from a diameter of 6 ft. 5⅛ in. at the firebox end to 5 ft. 8⅝ in. at the smokebox (both outside dimensions). It contains 129 small tubes 2⅜ in. dia., and 40 flue tubes, the latter containing triple superheater elements 1 in. outside diameter, so that the steam passing to the cylinders is split up into 120 paths. The boiler shell is constructed of 2 per cent. nickel steel, and the inner firebox, which is of copper, is extended into the barrel to form a combustion chamber.

The physical properties and analysis called for in the material used for the boiler and outer firebox shell, are as follow:—

Analysis	Per cent.
Carbon	0·2–0·25
Silicon	0·1–0·15
Manganese	0·5–0·7
Sulphur	0·04 max.
Phosphorus	0·04 ,,
Nickel	1·75–2·0
Physical Properties	
Maximum stress	34–38 tons per sq. in.
Yield point	17–19 ,, ,,
Elongation	22–24 per cent. on 8 in. gauge length
Reduction in area	50 per cent. min.
Ratio of yield point to maximum stress	50 ,, ,,

The table reproduced in the adjacent column, having reference to steel for boiler plates and staybolts and Monel metal stays, gives some actual representative figures for these materials obtained on test. The degree of relationship between the specified and actual figures can be noted therefrom under each of the different headings. This applies equally to the tables on page 305, referring to other portions of the construction.

Material	Maker	Cast No.	Breaking stress, tons per sq. in.	Elongation, %	Ratio, y.p./m.s. %	Contr'n. of area, %	Bend test	Chemical analysis														
								C %	Si %	Mn %	S %	P %	Ni %	Cu %	Cr %	Mo %	Fe %	Si %	S %	C %	Brinell hardness No.
Acid nickel steel boiler plate	Colvilles Limited	B. 7364	36·3	25·0	62·8	54·2	Sides parallel 1⅞ in. apart without fracture	0·22	0·12	0·64	0·030	0·032	1·96								
			36·8	23·0	60·8	51·0	Do. 1⅜ in.	0·215	0·13	0·65	0·033	0·030	1·83								
		D. 7305	35·7	23·0	66·1	54·0	Do. 1⅝ in.														
		,,	35·4	23·5	66·9	52·4	Do. 1¾ in.														
		C. 6960	34·8	24·0	59·6	56·8	Do. 1 1/16 in.	0·25	0·15	0·69	0·034	0·026	1·84								
			34·2	24·0	59·0	54·3	Do. 1 1/16 in.														
		D. 7189	35·8	26·0	63·9	56·8	Do. 1⅛ in.	0·22	0·13	0·66	0·030	0·030	1·83								
		,,	35·7	24·5	64·7	53·8	Do. 1⅛ in.														
		C. 6692	34·9	26·0	55·9	52·6	Do. 1¼ in.	0·245	0·13	0·62	0·024	0·029	1·85								
		,,	34·8	27·0	56·8	55·6	Do. 1 3/16 in.														
		Y. 6932	35·8	23·0	59·4	52·8	Do. 1¼ in.	0·23	0·13	0·59	0·029	0·031	1·80								
		,,	34·5	22·0	59·2	50·3	Do. 1⅛ in.														
Specified:			*34/38*	*24/22*	*50 min.*	*50 min.*		*0·2/0·35*	*0·1/0·15*	*0·5/0·7*	*max. 0·040*	*max. 0·040*	*1·75/2·00*								
Acid steel bars for boiler stays (Transverse & Longitudinal)	Colvilles Limited	A. 6653	41·9	20·0	63·4	55·0	180° sides parallel, 1 in. apart without fracture	0·265	0·10	1·70	0·031	0·040									
		,,	41·9	22·0	64·4	56·4															
Specified:			*37/43*	*18 min.*			*180° w.f.*	*0·22/0·28*													
								Ni %	Cu %	Mn %	Fe %	Si %	S %	C %							
Hot rolled Monel metal	Henry Wiggin & Co. Ltd.	3153	34·8	52·0	16·0	76·4		68·41	28·83	1·03	1·55	0·05	0·010	0·10						121	
		2999	36·4	52·0	14·8	74·4		66·58	31·13	0·96	1·11	0·05	0·005	0·14						126	
Specified:			*30/35*	*35·0*	*14/17*															*110/120*	

For reference to this table see also page 306

Material	Maker	Cast No.	Breaking stress, tons per sq. in.	Elongation, %	Yield point, tons per sq. in.	Contr'n. of area, %	Bend test	Chemical analysis C %	Si %	Mn %	S %	P %	Ni %	Cu %	Cr %	Mo %	Izod impact test Ft.-lb. 1	2	3	Heat treatment
High tensile acid steel frame plate grade "B"	Colvilles Limited	C. 6689	37·0	23·0	23·9	53·1	Do. 1⅜ in.	0·235	0·13	0·90	0·031	0·032		0·32	0·365					
		,,	37·2	24·0	23·8	55·8	Do. 1 5/16 in.													
		B. 7369	36·1	25·0	22·0	54·0	Do. 1¼ in.	0·245	0·10	0·90	0·031	0·027		0·36	0·42					
		,,	35·4	22·0	22·2	42·8	Do. 1⅜ in.													
		B. 7362	36·0	23·5	22·1	50·1	Do. 1⅛ in.	0·23	0·10	0·91	0·031	0·029		0·35	0·39					
		,,	36·8	24·0	24·1	47·5	Do. 1⅜ in.													
		D. 7350	38·1	23·0	22·2	51·8	Do. 1⅛ in.	0·25	0·11	0·97	0·032	0·035		0·35	0·39					
		,,	37·9	22·0	22·1	51·2	Do. 1⅜ in.													
		D. 7349	38·4	24·0	22·3	50·6	Do. 1⅜ in.	0·25	0·10	1·03	0·034	0·034		0·38	0·32					
		,,	39·1	23·0	23·1	48·2	Do. 1¼ in.													
		,,	39·9	23·0	23·8	47·6	Do. 1 5/16 in.													
Specified :			*35/40*	*20 min.*	*22 min.*	*40 min.*		*0·20/0·25*	*0·10/0·20*	*0·85/1·0*	*0·040*	*0·040*		*0·30/0·50*	*0·45*					
Vibrac steel coupling and connecting rods	The English Steel Corpn. Limited (Vickers Works)	P. 7151/4	56·0	On 2 in. 25·0		63·6	180°	0·295	0·22	0·60	0·029	0·028	2·45		0·66	0·59	50	42	40	Hardened : 850° C. oil Tempered : 650° C. air 620° C. air
		16168/3	57·3	23·0		59·2	180° W.F.	0·325	0·22	0·57	0·031	0·032	2·53		0·58	0·63	55	54	49	Do.
		P. 6859/32	55·0	22·5		60·4	,,	0·325	0·26	0·63	0·027	0·028	2·62		0·68	0·60	65	63	62	Do.
		3049/1	56·8	21·5		57·0	,,	0·32	0·21	0·57	0·038	0·029	2·58		0·56	0·55	44	47	47	Do.
Specified :			*50/60*																	

Material	Maker	Cast No.	Breaking strength, tons per sq. in.	Elongation, %	Ratio, yp./bs., %	Contr'n. of area, %	Cold bend test, 1½ in. sq.	Chemical analysis C %	Si %	Mn %	S %	P %	Ni %	Cr %	Izod impact test Ft.-lb. 1	2	3	Heat treatment	Spec'd. deflection	Total deflection in inches produced by a weight of 2,240 lb. falling successively from heights of :— 10 ft.	15 ft.	20 ft.	25 ft.	30 ft.	30 ft.	30 ft.	30 ft.	30 ft.
Acid steel loco. axles*	Steel, Peech & Tozer	19/9815	37·58	On 3 in. 28·3	61·2	54·20		0·26	·211	·85	·033	·030						Reheated to 860° C. and oil quenched for 4 minutes	Without fracture								
	,,		37·05	30·6	61·2	55·88	180° E.T.W.F.																				
Specified : ...			*35/40*	*25/20*			*180° E.T.W.F.*				*·040 max.*	*·040 max.*															
Acid steel loco. tyres 3 ft. 2⅜ in. i/d. pony truck†	English Steel Corpn. Ltd.	P. 6726	60·5	On 2 in. 15·5		24·6		·61	·31	·56	·030	·031	·13	·57	3·0	6·0	4·0		2·2	¼	¾	1⅛	2¼	3⅛	3¾	Without fracture		
Specified : L.M.S.R. 8D. class "DC"			*56/62*	*13/11*							*·040 max.*	*·040 max.*															
Acid steel loco. tyres 6 ft. 2⅜ in. i/d.	Steel Co. of Scotland Ltd.	U. 450	53·37	21·0		33·4		·52	·298	·72	·031	·028			4·0	4·0	3·0	Reheated to 830° C. quenched in oil, tempered 650° C.	10¾	¼	¾	1⅛	2⅜	4 1/16	5⅛	6 3/16	7 3/16	8⅜	9 5/16
																				30 ft. 10 7/16	20 ft. 10⅜	30 ft. 11 7/16	30 ft. 12¼	Without fracture				
Specified : L.M.S.R. 8D. Class "CB"			*50/55*	*18/15*							*·040 max.*	*·040 max.*							*The total deflection to be not less than the specified deflection*								

* Axles were subjected to a falling weight test in the following conditions : Weight of 2,240 lb., falling from 35 ft. Dia. at centre 6¾ in., and distance between supports 5 ft. Deflections under 5 blows were 3½ in. ; straight, 3 3/16 in. ; straight ; and 3 5/16 in. ; all without fracture

† "As rolled" condition. Also represents bogie tyres (same cast)

For reference to the above tables see pages **307-311**

The normal carbon steel used for locomotive boiler plates has a tensile strength of 26-30 tons per sq. in. with an elongation of not less than 22 per cent. on a gauge length of 8 in. The increased tensile strength of the nickel steel has allowed the following reductions in thickness and savings in weight to be made on the *Coronation* boiler as compared with what would have been the case had carbon steel been used.

	Nickel steel boiler as built Thickness of plates In.	Boiler if made of mild steel Thickness of plates In.	Increase in weight of mild steel boiler over nickel steel T.	Cwt.	Q.	Lb.
First barrel	5/8	13/16	12	0	6	
Inside cover strap	9/16	3/4	1	0	1	
Outside ,,	9/16	3/4		1	25	
Liner for top feed seating	9/16	11/16		1	3	
Second barrel	11/16	7/8	14	0	0	
Inside cover strap	9/16	3/4	1	0	9	
Outside ,,	9/16	3/4		2	2	
Liner for dome seating	13/16	1		2	13	
Throat plate, top half	3/4	7/8		2	17	
Throat plate, bottom half	3/4	7/8	2	1	20	
Firebox backplate	9/16	5/8	1	0	24	
Steel wrapper	1/2	5/8	9	0	3	
			2	3	1	11

From the above figures, it will be noted that a saving of over two tons was obtained in the construction of the boiler shell and firebox by the use of the nickel steel, the empty weight of the boiler, including mountings, being 28 tons 3 cwt. 2 qr. This represents a most valuable gain, as it permits of a boiler being used of the maximum diameter which can be mounted between the coupled wheels and within the loading gauge, and it is to be noted that the boiler centre is placed 9 ft. 6 in. above rail level. No diversion from normal practice was necessary in bending the nickel steel barrel and wrapper plates; the cutting procedure, however, required some modification. Whereas for ordinary mild steel plates, oxy-acetylene is used, and the plate cut with only a small chipping allowance, coal gas was used for the nickel steel plates, as this gives a less severe chill effect and prevents consequent cracking. An additional chipping margin was allowed against such chilling effects as were present. Annealing treatment was carried out on the throat plates to relieve the stresses caused by local heating during manufacture, but, we are informed, it may be possible to eliminate this procedure in future, by using a special setting block, so that the complete bending operation may be carried out with a general heat on the whole plate. Annealing was also required for the butt straps, for the reason that in the untreated condition, the chilling which occurs after the flame cutting is detrimental to the life of the planing tools.

It is the standard practice on the L.M.S.R., in boilers pressed to 250 lb. per sq. in., for certain portions of the longitudinal barrel seams of the steel wrapper plates to be welded. In the case of nickel steel, certain precautions are essential in the welding, to obviate hardness in the heat-affected zone of the parent plate adjacent to the weld; this is overcome by the use of specified electrodes, and a technique which ensures that sufficient heat is generated due to comparatively slow manipulation of the rod, thus obviating a severe quenching action. In addition, the pads for boiler mountings and various snubs and hand-rail pillar brackets are dealt with in like manner.

The inner firebox is of copper, and it is specified that the plates shall contain not less than 99·2 per cent. of copper; not less than 0·30 per cent. nor more than 0·50 per cent. of arsenic; not more than 0·05 per cent. of antimony nor more than 0·01 per cent. of bismuth. The tensile strength called for is a minimum of 14 tons per sq. in. with an elongation of not less than 35 per cent. measured on a length of 8 in. The firebox staybolts are of steel, except for those portions of the firebox sides subject to the greatest relative movement due to expansion, in which case they are of Monel metal. The steel stays, which are ½ in. diameter in the turned-down centre portion, are made from acid steel bar for which a tensile strength of 32-37 tons per sq. in. is called for, with a minimum elongation of 23 per cent. on 2 in. gauge length. The carbon is from 0·12 to 0·18 per cent. The Monel metal stays have a diameter of ⅝ in. in the turned-down portion. This material has a high ductility similar to copper, but combined with a higher tensile strength, which enables a smaller diameter stay to be used for a given strength, and this in consequence, increases the ratio of length to diameter of the stay, making for greater flexibility. This feature is particularly advantageous for the reason, as is well known, that the majority of firebox stay failures are due more to fatigue than to excessive stress. The breaking strength of the Monel metal bar used for making the stays is specified as 30-35 tons per sq. in., with an elongation of 35 per cent. on a 2 in. gauge length. The Brinell hardness of the material is 110/120.

It is customary for Monel metal to be supplied to a chemical analysis as follows:—

Nickel, not less than 64 per cent. nor more than 70 per cent..
Manganese, not less than 0·3 per cent. nor more than 2·0 per cent.
Iron, not more than 2·5 per cent.
Total impurities, not more than 0·3 per cent.
Copper, the remainder.

The figures appearing in the table on page 304 under the heading of "Chemical Analysis," should therefore be read as applicable to the case of the L.M.S.R. locomotives which form the subject of this article.

While on the subject of the boiler, it will be of interest to refer to the material used for the smokebox, smokebox door, and ashpan, parts of which are subject to the corrosive action of hot ashes. These parts are made of copper-bearing steel, the specification calling for a steel having 0·30 to 0·35 per cent. of copper, and not more than 0·06 per cent. of sulphur or phosphorus. The tensile strength of this material is 28-32 tons per sq. in., and no difficulty is experienced in fabricating it by welding, as in the case of the ashpan. The use of this steel is based on the findings of the Research Committee of the Iron and Steel Institute, which have indicated its increased resistance to corrosion, as compared with mild steel.

The Engine Main Frames

The main frames of the engine are made of a special high tensile acid steel, and are 1⅛ in. thick. At each side at the hind end, two separate frame plates are spliced to the main frames, and carried through to the hind buffer beam. The outer frames are splayed outwards, and the inner frames inwards, to take the side bearers for the trailing two-wheeled truck.

The required specification entailed a considerable amount of investigation, which was carried out by the railway company on various special steels, particularly from the point of view of welding and cutting by oxy-coal gas and oxy-acetylene. From the results obtained, a specification was drawn up limiting and controlling the carbon, manganese, and chromium contents, and to ensure that the heat and quenching effect of a cut edge, or in the zone adjacent to a weld, should not give rise to

excessive hardness. The analysis and physical properties of the steels used on the frames are as follow:—

Analysis	Per cent.
Carbon	0·20–0·25
Silicon	0·10–0·20
Manganese	0·85–1·0
Sulphur	0·04 max.
Phosphorus	0·04 max.
Chromium	0·45 max.
Copper	0·30–0·50
Physical Properties	
Maximum stress	35–40 tons per sq. in.
Yield point	22 tons per sq. in. min.
Elongation	20 per cent. min.
Reduction in area	40 ,, ,,

Figures taken from the actual tests made on this material are as follow:—

Physical tests

Cast	Breaking stress, tons per sq. in.	Elongation, per cent.	Ratio yield to maximum stress, per cent.	Contraction of area, per cent.
A	36·1	25·0	22·0	54·0
	35·4	22·0	22·2	42·8
B	36·0	23·5	22·1	50·1
	36·8	24·0	24·1	47·5

Chemical Analysis

Cast	C	Si	Mn	S	P	Cu	Cr
A	0·245	0·10	0·90	0·031	0·027	0·36	0·42
B	0·23	0·10	0·91	0·031	0·029	0·35	0·39

Although steps were taken in the specified analysis to obviate hardness on gas-cut edges, certain precautionary measures were found advisable, such as cutting speeds slower than the normal; or, alternatively, subsequent tempering after the cutting of the edge by blowpipe. During the welding of such steels, pre-heating was resorted to where possible, but where not practicable, the deposition of weld metal was done slowly with a view to reducing severe quenching action. The higher tensile strength of this material allows the frames to be made of $1\frac{1}{8}$-in. plates instead of the $1\frac{1}{4}$-in. which would be necessary with ordinary carbon steel. The total weight saved on a pair of frames by this means is 17 cwt.

Cylinders and Motion

In this locomotive there are, as previously stated, four cylinders $16\frac{1}{2}$ in. dia. × 28 in. stroke. Steam is distributed by piston valves of 9 in. diameter, having a maximum travel of $7\frac{5}{32}$ in. These valves are actuated by two sets of Walschaerts gear situated outside the frames, which drive the outside piston valves direct, and the inside ones by means of rocking levers; the whole arrangement is specially designed to allow the removal of both sets of valves for examination with the minimum amount of trouble. The valve motion is provided with Hoffman needle bearings, except the return crank ends of the eccentric rods, which are fitted with SKF self-aligning ball bearings.

The inside cylinders drive the crank axle of the leading coupled wheels, whilst the connecting rods of the outside cylinders drive on the crank-pins of the second pair of coupled wheels direct.

The mixture used in the manufacture of the cylinders was comprised of 50 per cent. cylinder scrap and 50 per cent. special low phosphoric pig iron. The analysis of a typical cylinder mixture is as follows:—

Carbon	3–3·3 per cent.	
Silicon	1·2–3 ,,	
Manganese	0·8–0·9 ,,	
Sulphur	0·1 ,,	max.
Phosphorus	0·5 ,,	,,

The cupola melting of this metal was carefully controlled, and the tapping and casting temperatures carefully watched by means of a Cambridge disappearing filament pyrometer. The cylinders were cast at a minimum temperature of 1,250° C. The metal for the piston valve liners, piston heads, and piston rings, is of similar material, and the same method of control was adopted for these details. In addition to the cylinder castings themselves, test bars were also cast; these were of the L.M.S.R. standard rectangular specimen for transverse breaking load, approximately 3 ft. 6 in. long by 2 in. by 1 in., the centres for breaking being taken at 36 in. The specification for these bars is: breaking stress minimum 30 cwt., with minimum $\frac{1}{2}$ in. deflection. From the bar a hardness survey is made of the cross section, the Brinell numbers generally being in the neighbourhood of 220-230. Test bars are also cast integrally with the cylinder for tensile and transverse tests, the transverse centres in this case being 12 in. The maximum stress obtained is in the region of 15-16 tons per sq. in.

Although more closely connected with the reciprocating parts to be discussed later, it is convenient to refer to the piston valves, the material being the same as in the case of the cylinders. Here, however, the design has been modified to allow a lighter web than usual to be used. This valve is illustrated,* and the total weight saved for the four sets of valves is 96 lb. over the standard design. The weight of the four piston valves complete with spindles is 4 cwt. 2 qr.

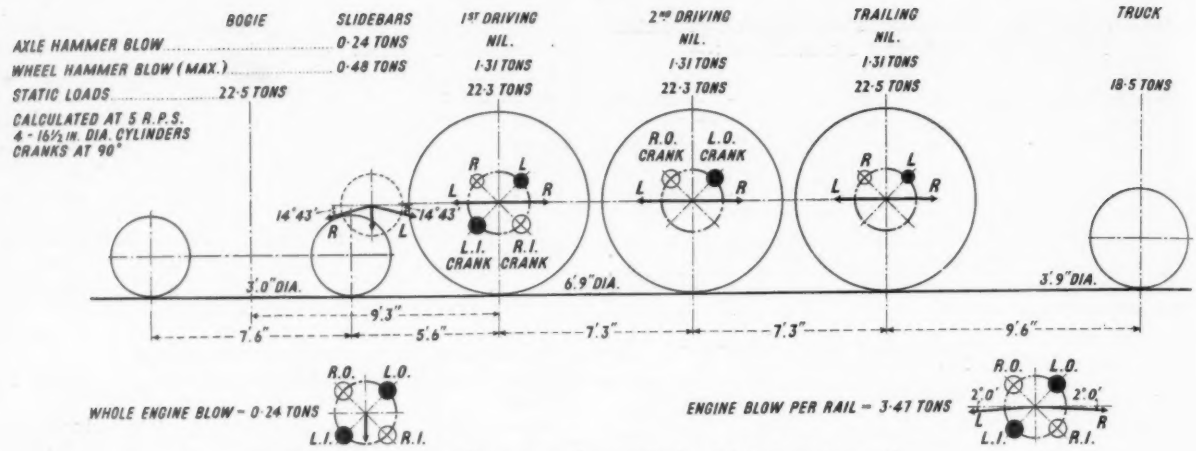
Weight Reduction and Balancing

In the *Coronation* engine, 50 per cent. of the reciprocating weights are balanced, equally divided over the three coupled axles (see drawing on p. 308). In a four-cylinder engine, it is possible to eliminate axle hammer blow altogether, so long as the same amount of reciprocating weight is balanced in both the inside and outside motions. There remains, however, a small hammer blow on each wheel, and it is therefore desirable to reduce the value of the weights as far as possible. In the " Princess Royal " class locomotives, the hammer blow on each coupled wheel is 1·31 tons. For the whole engine, it is 0·24 tons, and for the whole engine per rail 3·47 tons. Exactly the same figures obtain for the new " Princess Coronation " class engine.

It is interesting to consider how this was achieved, since the arrangement of the parts is different in the two engines. The length of the outside connecting rods has been increased in the streamlined class from 9 ft. to 11 ft. between centres, and as already indicated, the inside valve gear has been eliminated. Taking the outside motion first, the weight of the reciprocating parts, including 47 per cent. of the outside connecting rod, is 673 lb. per cylinder in the *Coronation* engine, as against 676 lb. in the *Princess Royal*. It has been found possible by the use of Vibrac steel to produce an 11-ft. connecting rod some 7 lb. lighter than the 9-ft. rod of the earlier engine, which was of manganese-molybdenum steel, the weight of the former being 366 lb. The weight per cylinder of the inside reciprocating parts is 640 lb., including 40 per cent. of the inside connecting rod weight, as against 715 lb. in the *Princess Royal*. This reduction is due to the absence of inside valve gear and parts attached to the crosshead, and also due to a lighter inside connecting rod made of Vibrac steel of fluted section. The inside and outside connecting rods of the *Coronation* engine, are shown in the drawings.* The coupling rods are also of Vibrac steel, of fluted section. A saving in weight of 412 lb. on the set of four rods was obtained, compared with the previous engine, but it must here be stated that the length between the outer centres has been reduced from 15 ft. 3 in. to 14 ft. 6 in., the weight per engine of the coupling rods, complete, being 908 lb. These rods are also

* See folding plate

XUM



Wheel balancing diagram. Four cylinder 4-6-2 type locomotive

illustrated.* The lighter weight of the revolving parts is naturally reflected in a reduction in the balance weights carried in the wheels, and to sum up the effect of the Vibrac steel, and the re-design made possible, it may be stated that a total saving in weight of approximately 1,000 lb. was obtained in the reciprocating and revolving parts. The steel named gives a breaking strength of 50-60 tons per sq. in., with an elongation of 20-25 per cent., and a value of over 40 lb. in the Izod impact test.

The steel is of the well-known nickel-chromium-molybdenum type, which is forged and heat treated with a test bar attached. The heat treatment consists of oil quenching from a temperature of 840° C., followed by tempering at a visible red heat from 650-670° C., in order to relieve the hardening stresses, and the rods are subsequently allowed to cool in air from the tempering temperature. As this steel contains certain proportions of molybdenum, it is free from temper brittleness. It has been found, when certain details are quenched from the tempering temperature, that on machining there is a release of stresses which causes warping in the detailed part, and this has been obviated by the method described. This steel, which has high tensile values, is admirably suited for the stresses occurring in locomotive coupling and connecting rods. It is interesting to note that in machining these rods, the increased tensile strength made it necessary to reduce the machining speeds and feeds by about 20 per cent., as compared with the practice in plain carbon steel components.

Axles, Wheel Centres, and Tyres

The axles for the locomotive were made to the L.M.S.R. standard specification, which calls for an acid open-hearth steel containing not more than 0·04 per cent. of sulphur and phosphorus. A tensile breaking strength of 35-40 tons per sq. in. is called for, with an elongation of not less than 25 per cent. with 35 tons breaking strength, or 20 per cent. with 40 tons breaking strength, the elongation being measured on a gauge length of 3 in. In addition, a falling weight test on a selected axle is undertaken, in which the axle is placed upon bearings, and must withstand, without fracture, five blows from a weight of one ton falling from a height of 35 ft., the distance between the points of support being 5 ft.

Representative actual test figures for steel for this purpose, are as follow:—

Breaking strength	37·58 tons per sq. in.
Elongation on 3 in.	28·3 per cent.
Ratio yield point to breaking strength	61·2 ,,
Contraction of area	54·2 ,,

* See folding plate

Chemical Analysis	per cent.
Carbon	0·26
Silicon	0·211
Manganese	0·85
Sulphur	0·033
Phosphorus	0·030

In the falling weight test as above specified, the deflections produced by each successive blow were as follows:—

1st blow	3½ in.
2nd blow	Straight
3rd blow	3 5/16 in.
4th blow	Straight
5th blow	3 1/16 in. without fracture

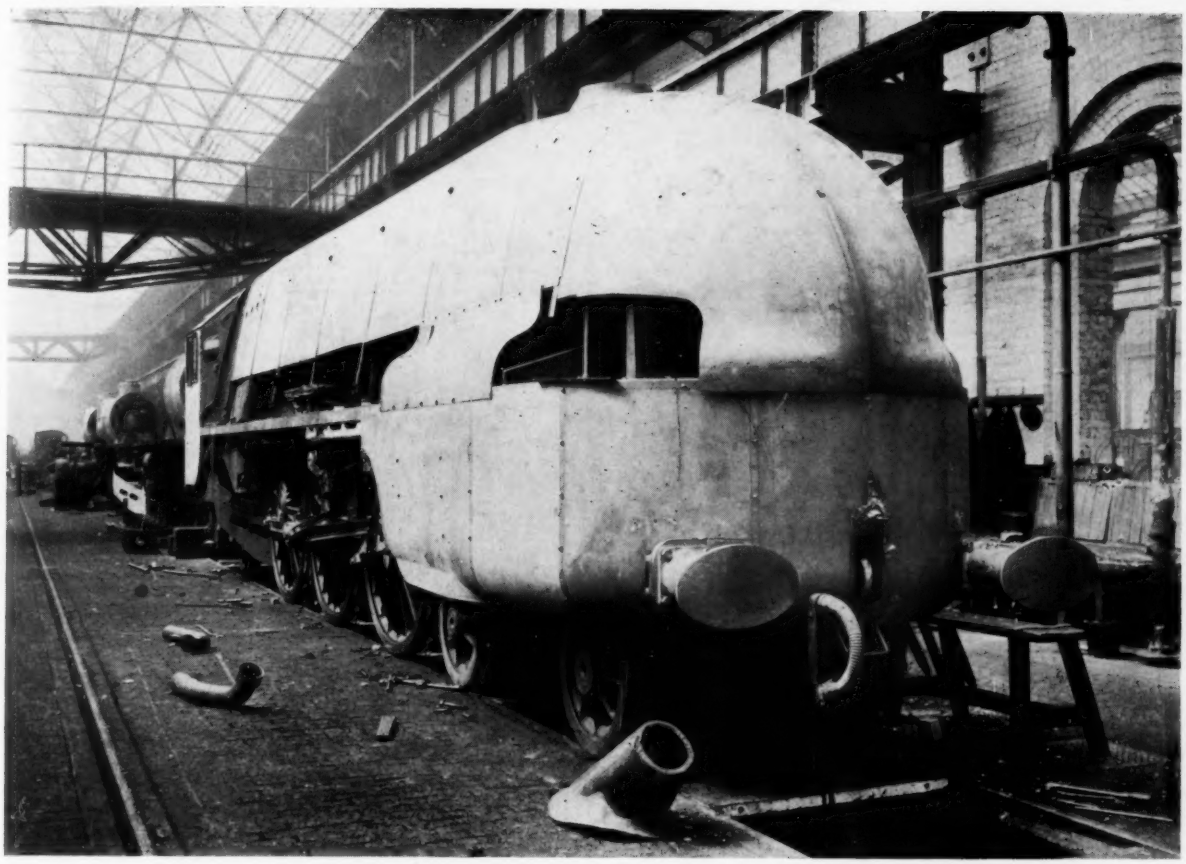
The axles are oil treated at the makers' works. In order to save weight, the axles are bored out along their axes, and the following particulars give the size of the holes and the weight saved:—

	Dia. of hole	Weight saved Cwt.	Qr.	Lb.	Actual weights T.	Cwt.	Qr.
2 : bogie	2 in.	1	0	9		9	0
1 : 1st coupled	3 in.	1	0	9	2	4	3
2 : 2nd and 3rd coupled	4½ in.	5	2	15	1	1	2
1 : pony truck	3 in.	1	2	13		8	3
Total		9	1	18	4	4	0

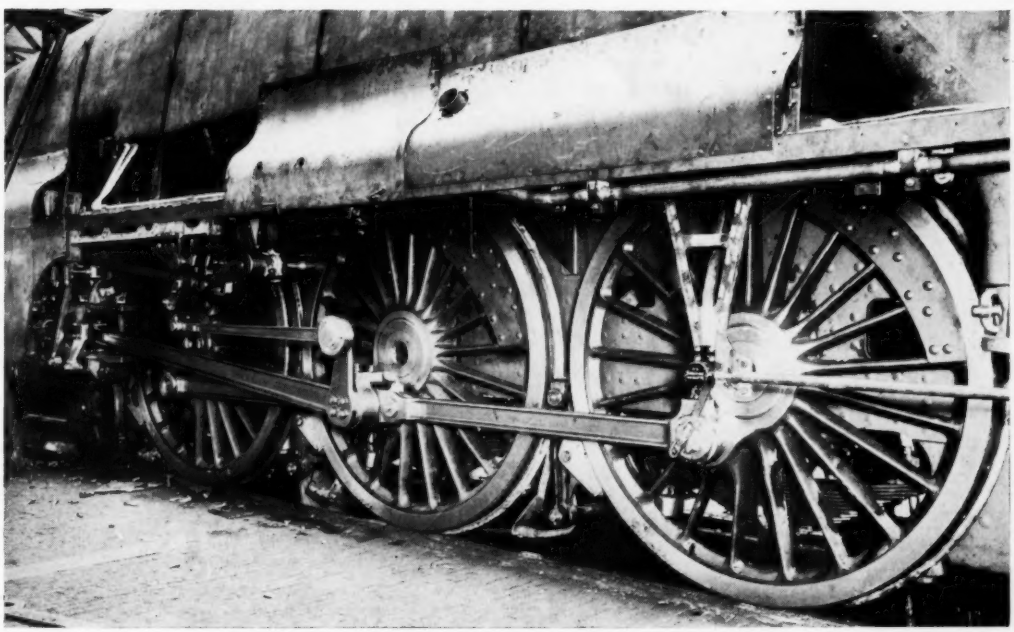
From this, it will be seen that nearly ½ ton was saved by boring the six axles of the locomotive alone. The process of boring out the axles was undertaken on a special lathe on which the holes were bored throughout the entire length of each axle. A special high-speed steel stepped cutter was used for the operation of rough boring; at a speed of 54 r.p.m. with a feed of 0·228 in. per min. The hole was then finished with a four-cutter reamer at a speed of 8 r.p.m., and a feed of 0·37 in. per min. It was found necessary to remove the steel chips with a forced lubricant on the tool at a pressure of 80 lb. per sq. in. The axles were then finished off in the grinding machine, where ·015 in. of metal was removed from the diameter of the wheel seats and journals. Finally, the keyways were cut, and the axles were then ready for the fitting of the wheel centres. This process is shown in the illustration at the top of page 310.

The next items to be considered are the wheel centres; the metal for these, as well as for the other steel castings required, was melted in Sesci pulverised-fuel rotary furnaces,* using charges consisting of recovered steel

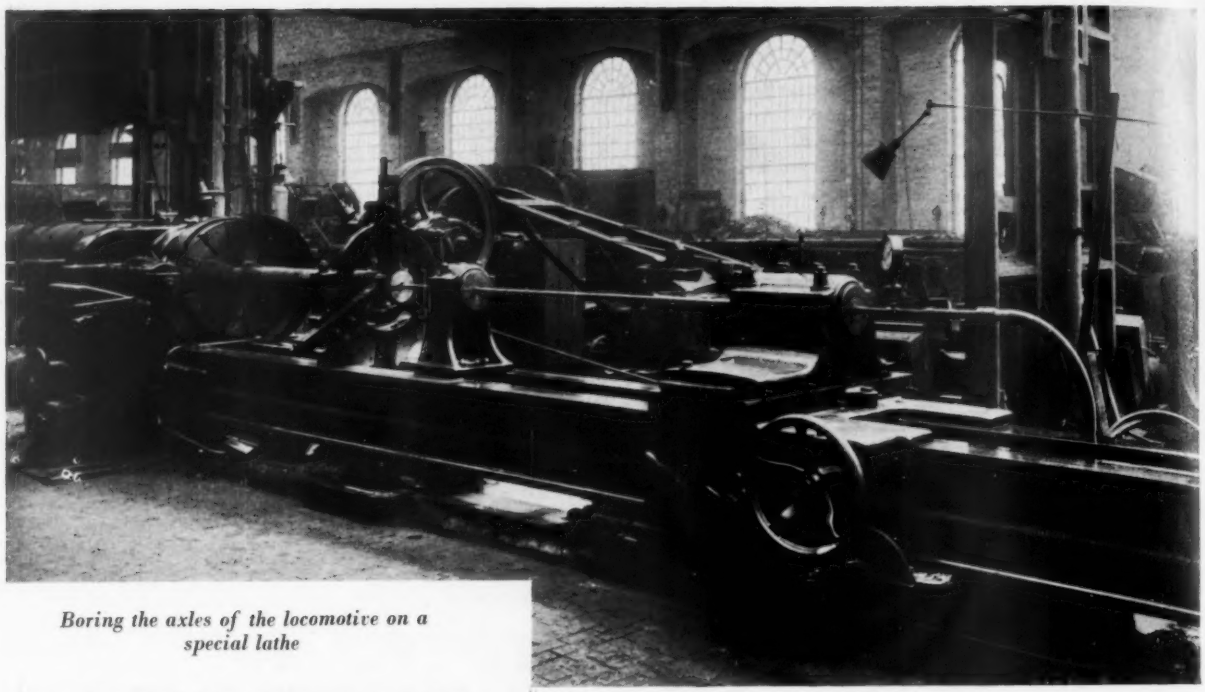
* The installation of these furnaces at the L.M.S.R. Crewe works was described in THE RAILWAY GAZETTE dated September 25, 1936



Engine partly completed in Crewe works. Streamlining casings in course of erection



Wheels, rods, and motion. The hollow axles effect a saving of 10 *cwt. in weight*



Boring the axles of the locomotive on a special lathe

scrap. The moulding sand was prepared in a Baillot sand-mixing plant, and the moulds dried in temperature-controlled ovens operated with Hermann heating elements; the castings were annealed in pulverised-fuel furnaces fitted with a pyrometric outfit.

The metal was manufactured to give a tensile strength of 26 tons per sq. in., to 20 per cent. minimum elongation, the sulphur and phosphorus contents being limited to 0·06 per cent. A low carbon steel was found to satisfy the specified physical requirements, and below are typical results of the tests of the above practice:—

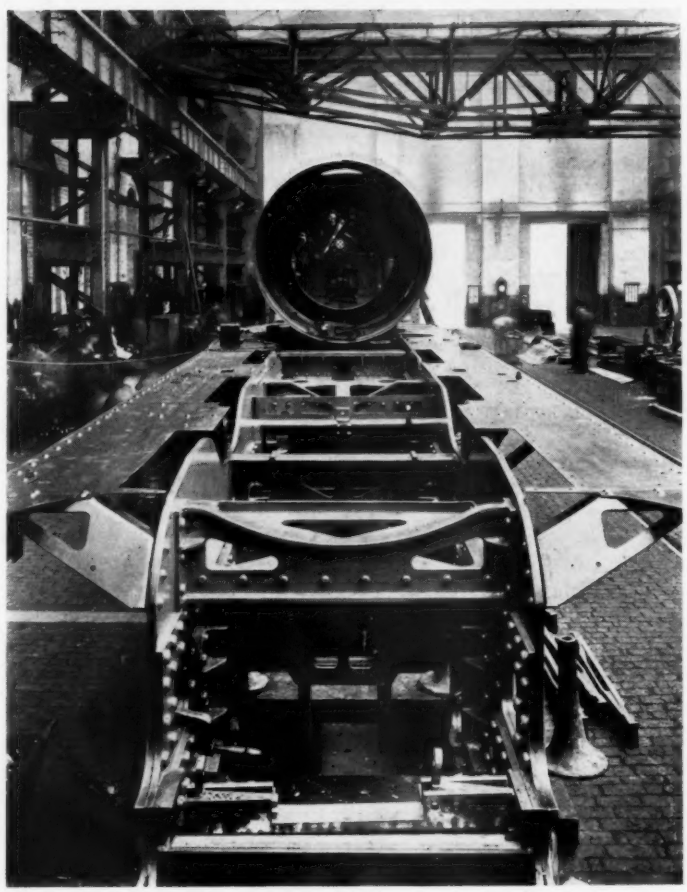
	Cast C-9-64 per cent.	Cast C-9-65 per cent.	Cast C-9-37 per cent.
Carbon	0·20	0·18	0·20
Silicon	0·318	0·320	0·280
Manganese	0·70	0·63	0·64
Sulphur	0·054	0·054	0·058
Phosphorus	0·042	0·047	0·041
Tensile, tons per sq. in.	28·80	27·80	29·00
Elongation, per cent. ..	30·00	34·00	35·00
Contraction of area, per cent.	42·00	54·80	52·40

The bend test pieces passed through 180° without fracture.

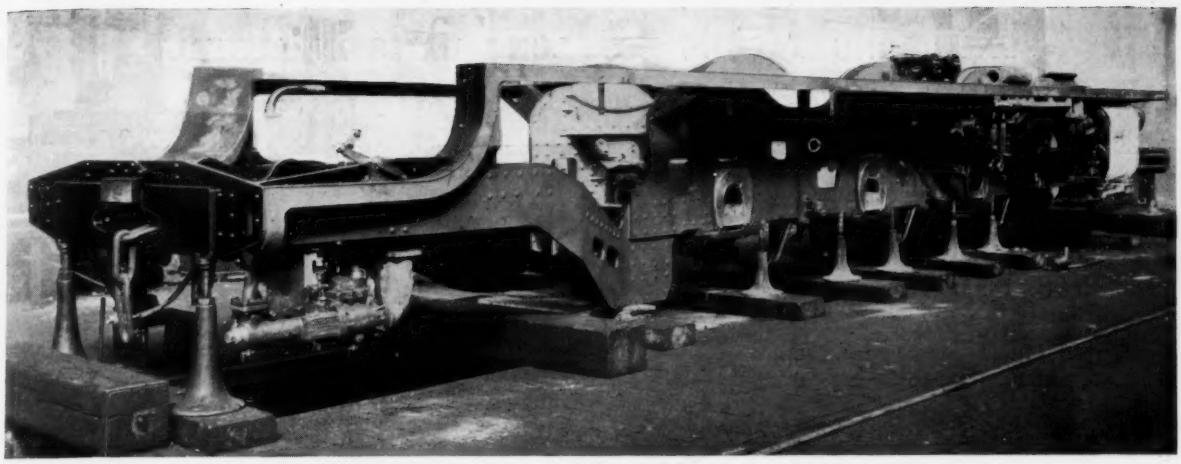
The coupled wheel tyres of the engine are of acid steel, 6 ft. 2¾ in. inside diameter before machining. A typical test result of this material is given below:—

	Specified	Actual
Breaking strength, tons per sq. in...	50/55	53·37
Elongation, per cent.	18/15	21
Contraction of area, per cent.	—	33·4
Carbon	—	0·52
Silicon	—	0·298
Manganese	—	0·72
Sulphur	0·04 max.	0·031
Phosphorus	0·04 max.	0·028

In addition to the foregoing, falling-weight and impact tests are called for in L.M.S.R. specifica-



View of main frames from above showing stretchers and brackets



The main frames of the engine are 1⅛ in. thick and made of a special high tensile acid steel

tions. In the former, every tyre selected for test is to be placed in a running position, with the tread resting on a block of metal of not less than 5 tons weight, supported on a rigid foundation; it must withstand, without fracture, blows from a falling weight of one ton, the weight being allowed to fall freely from heights of 10, 15, 20, 25, and 30 ft., until the deflection of the tyre corresponds to that given by the formula $\frac{(D\text{-}3\ S)^2}{45T^2}$, where:—

D = internal diameter of tyre.
T = thickness at middle of tread.
S = depth of snip.

In a representative actual test on these lines, 14 successive blows were withstood without fracture, the final deflection being 12¼ in. The impact test is made on a standard Izod test piece, 10 mm. square, cut as close to the surface of the tread as possible. The results of this test are taken for information only, and are not specified beforehand. On actual test, a figure of 4 ft.-lb. represents an average result.

The requirements of the bogie and pony truck tyres are slightly different as regards physical characteristics, and a typical test result for this material, is as follows:—

	Specified	Actual
Breaking strength, tons per sq. in. ..	56/62	60·5
Elongation, per cent.	13/11	15·5
Contraction of area	—	24·6
Carbon	—	0·61
Silicon	—	0·31
Manganese	—	0·56
Sulphur	0·04 max.	0·030
Phosphorus	0·04 max.	0·031
Nickel	—	0·13
Chromium	—	0·57

Falling weight and Izod impact tests are taken in the same way as on the coupled wheels. The heat treatment consisted of re-heating to 830° C., quenching in oil, and tempering to 650° C.

Machining Wheel Centres and Tyres

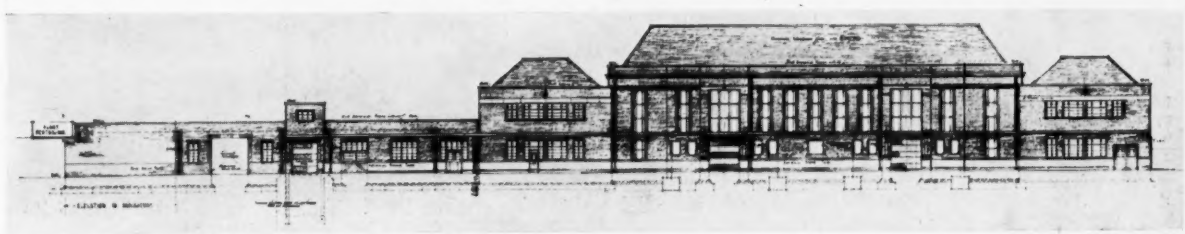
The 6-ft. 3-in. dia. wheel centres were machined on vertical boring machines, using tools tipped with Stellite 40, for roughing out at a speed of 30 ft. per min., with a feed of 0·074 in. and ¾ in. depth of cut. In order to obtain a satisfactory finish, Cutanit tipped tools working at a speed of 627 ft. per min., a feed of 0·018 in., and 0·015 in. depth of cut, were used. After the keyways had been cut, the wheel centres were pressed hydraulically on their respective axles at a pressure of not less than 10 tons, and not greater than 12 tons per in. dia. of axle. The wheels were then mounted in a quartering machine, where the crank-pin holes were bored out to the correct angle prior to fitting of the crank pins and fixing the tyres.

The tyres were machined on a vertical boring machine, the rough boring operation, including the groove for the Gibson ring, being done in one cut at a speed of 53 ft. per min., feed of 0·065 in. and ⅞ in. depth of cut; Stellite-40 tipped tools were again used for this work. The finishing cut was performed with Cutanit tools at a speed of 600 ft. per min., feed 0·054 in., and cut of 0·015 in. The tyre was bored smaller than the wheel centre, to the formula:—

$$\frac{D}{1{,}200} + 0{\cdot}005 \text{ in.}$$

where D is the inside dia. of the tyre in inches.

It was then expanded by means of gas heaters, after which the wheel centre was placed in position, the Gibson ring fitted, and the tyres turned on the tread.



Architect's impression of the frontage of the new Doncaster Central station, L.N.E.R., as it will appear when completed

XUM

UNLOADING TACKLE FOR LONG RAILS IN AUSTRIA

A simple device that saves 65 per cent. in the cost of rail handling

THE length of rails has been continually increased in many countries during recent years, partly by the use of greater rolled lengths, but mainly by the welding of short rails. Rails up to 15 metres (49 ft. 3 in.) in length were laid in Austria before the war; 20-metre (65 ft. 7 in.) rails have been in use since 1928, and lengths of 25 metres (82 ft.) are now used on main lines and up to 56 metres (183 ft. 9 in.) on secondary roads. The carriage and unloading of long rails have therefore become a matter of greatly increased importance.

The Austrian Federal Railways have developed an unloading tackle which has already been used for some years with excellent results. Simple in construction, it has the further advantages that it can be applied to any open goods wagon and does not obstruct traffic on adjoining tracks. Fig. 1 shows a consignment of 56 metre (183 ft. 9 in.) rails on open trucks. The unloading trestle is shown in Fig. 2, and the rails are lifted one at a time by four roller-mounted pulley blocks (Fig. 3), which are then traversed across the trestle girder before lowering the rail.

Formerly, 30 men were required to unload a 25-metre (82 ft.) rail, and the cost was about 4.60 Austrian Schillings (3s. 8d. at the present rate of exchange). By means of the new device, the cost is reduced to about 1.60 Schillings (1s. 4d.) per rail, a saving of about 65 per cent. The total saving on the reconstruction of track is about 400 Schillings per track-kilometre, or nearly £26 per track-mile.

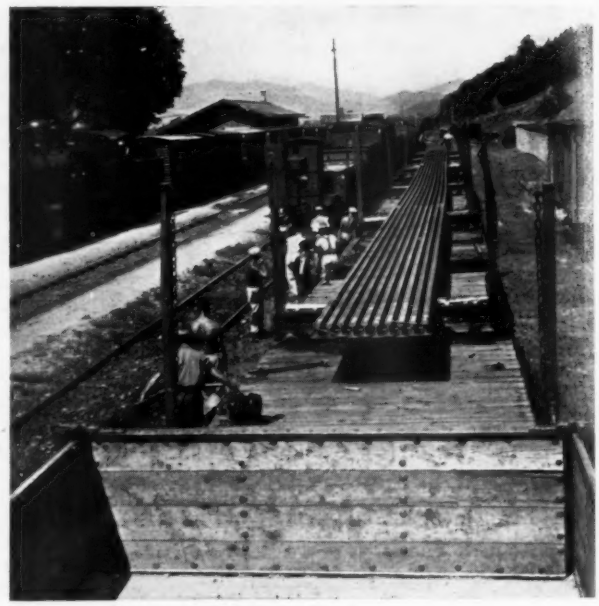


Fig. 1—Ten 56-metre (183 ft. 9 in.) rails on open trucks

Fig. 2—(Above): Unloading trestles ready for use

Fig. 3—(Right): Long rail lifted in the trestles, ready for lowering

FOREIGN VISITORS IN 1937.—The Travel and Industrial Development Association of Great Britain and Northern Ireland has recently issued a complete statement of the number of visitors to the United Kingdom from other countries during 1937. This shows that holiday visitors totalled 297,123 and business visitors 106,031 during this period, compared with respective figures of 245,865 and 87,950 in 1930.

A NEW UNIVERSAL FRAME-CUTTING MACHINE

Recently installed in the carriage and wagon shops at Swindon, G.W.R.

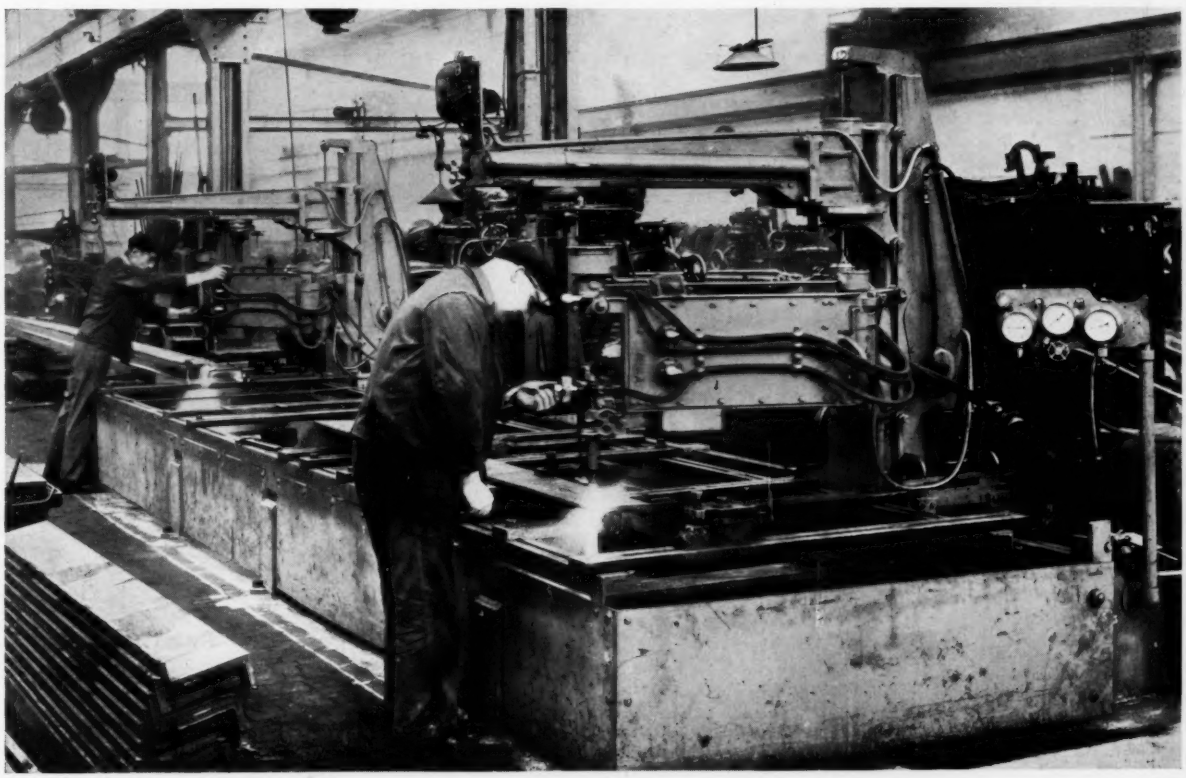
THE machine illustrated* was recently supplied by the British Oxygen Co. Ltd. to the Great Western Railway, and installed in the carriage and wagon shops at Swindon. It is used for cutting out and otherwise operating on a number of components used in the construction of railway carriages and wagons, and has effected considerable economies in time, labour, and consequent cost of producing the work. In the photograph reproduced, the operator in the foreground is seen cutting an angle section member for a carriage underframe, and simultaneously the one at the other end of the table is cutting the end of a solebar for the same class of underframe. The profile cut enables the end cut to fit neatly into the channel section of the headstock.

The machine comprises a large welded base with a column carrying two arms, each of which is perfectly balanced, and controllable with the minimum of effort. The top and smaller arm, which is in one piece, forms a slide from which hangs a template holder and supports. Beneath them, is the second and main arm, known as the folding gate arm. It carries at its extremity the cutter, the magnet coil, and the magnet roller. This last is held in vertical alignment with the cutter, and is surrounded by the magnet coil, both above the cutter. The roller is rotated by shaft drive through a variable gearbox, and is driven by an electric motor.

* By courtesy of Mr. C. B. Collett, Chief Mechanical Engineer, Great Western Railway

The engagement of a magnetic tracing roller with a steel or iron template representing the shape to be cut, constitutes the main principle of the machine. When rotating, the roller follows the path made by the edge of the template, whatever its shape may be, and as the cutter is in vertical alignment with it, a copy of the template is cut from the material beneath. The speed of cutting is constant, and unaffected by the shape of the template.

To suit the type of work in hand, the speed of cutting may be varied while the machines are working. Similarly, the height of the cutter can be adjusted to ensure that the required profile is obtained when material of uneven thickness, or having an irregular surface, has to be cut. All the gearing is enclosed, and the shafts run in ball bearings. Steel parts in almost any shape or any thickness of plate or forgings can be cut out by the machine. As a substitute for sawing and other methods of shaping, the machine can be used on the production of large forged articles, such as connecting rods, crank axles, and similar work. Cutting is by an oxygen and coal-gas flame with a central jet for conveying pure oxygen. The former gases are used for preheating, while the latter oxidises the material. It is important to use the correct size nozzle and pressures and cutting speeds, and the makers have provided the machine with instruments embodying oxygen pressure gauges and speed indicators which are at all times visible to the operator.



Operators at work on the new frame-cutting machine at Swindon works

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Scenes on the German State Railway

(Reproduced from the Reichsbahn-Kalender, reviewed on page 253 last week)

An interesting swing bridge over the River Pregel at Königsberg, carrying four railway tracks on the upper deck and a roadway with two tramway lines below. The bridge was built in 1926, and has a total length of 217 ft.

Express electric train on the Stuttgart - Munich - Berchtesgaden service, negotiating the picturesque section between Stuttgart and Ulm, with its sharp curves and steep gradients

RAILWAY NEWS SECTION

PERSONAL

NEW G.W.R. CHIEF ACCOUNTANT

The Great Western Railway announces the appointment of Mr. C. R. Dashwood, O.B.E., Assistant General Manager, to the position of Chief Accountant of the Great Western Railway upon the retirement of Sir Ralph Cope at the end of March.

Mr. William Matthews, Foreman, Caerphilly Locomotive Works, G.W.R., has been appointed Works Manager (Caerphilly) in succession to Mr. S. R. Jones, who has retired.

The directors of the Southern Railway recommend that Sir Herbert Walker, the late General Manager, be elected to the board in the place of Mr. F. Dudley Docker, who has intimated his intention to resign owing to pressure of other work.

Mr. C. C. Mallet, Director, Buenos Ayres & Pacific Railway, arrived in Buenos Aires on January 16, on a business visit.

The late Mr. Joseph Xavier Murphy, a Director of the Great Southern Railways, whose death on October 12 was recorded in our issue of October 22, left personal estate in England and Eire valued at £64,213.

INDIAN RAILWAY STAFF CHANGES

Mr. R. C. Case, Deputy Chief Controller of Standardisation (Mechanical), Central Standards Office for Railways, has been placed on special duty under the Railway Board as from November 8.

Mr. V. L. Thompson, Deputy Traffic Manager (T), A.-B.R., returned from leave and resumed his duties on November 19.

Mr. S. Simpson, Chief Electrical Engineer, N.W.R., has been granted nine months' leave as from January 5.

Mr. J. A. Tower, Chief Transportation Superintendent, G.I.P.R., has been granted 10¾ months' leave as from November 19 last.

Mr. A. G. Blake, Personal Assistant to the Locomotive and Carriage Superintendent, A.-B.R., has been appointed to act as Deputy Agent in place of Mr. W. H. Prendergast, who has been seconded for special duty as Deputy Agent (Organisation) with effect from January 12.

Mr. Cyril R. Dashwood, O.B.E., Assistant General Manager, G.W.R., has been appointed to succeed Sir Ralph Cope as Chief Accountant of the company at the end of March. Mr. Dashwood, who is a native of Norwich, joined the company's service at Swindon in 1902 at the age of fourteen, and in 1908 was transferred to the Chief Accountant's office at Paddington. In

Mr. Cyril R. Dashwood, O.B.E.
Appointed Chief Accountant, Great Western Railway

April, 1916, he was appointed Bookkeeper, and in January, 1919, Assistant Accountant in the Audit Section. Mr. Dashwood was Secretary to the Railway Accountants' Committee dealing with the Railway Companies (Accounts and Returns) Act, 1911, and to the Accountants' Permanent Committee which was set up when the former committee ceased to exist. In August, 1914, he was made Secretary of the Accountants' Sub-Committee of the Railway Executive Committee, and, from its inception, of the Compensation Accounts Sub-Committee which dealt with the railway companies' claims under the Government control agreements. He was appointed an Officer of the Order of the British Empire for his services in connection with the last-named committees. Mr. Dashwood was appointed Assistant Accountant of the Great Western Railway in 1922, and Assistant General Manager in 1934. He is a Director of the City of Oxford Motor Services Limited, the Devon General Omnibus & Touring Co. Ltd., and the Penarth Pontoon, Slipway & Ship Repairing Co. Ltd. He has also acted as financial liaison officer on behalf of the four main-line railway companies since they acquired a controlling interest in the businesses of Carter Paterson & Co. Ltd. and Pickfords Limited. Mr. Dashwood is a keen golfer and is Captain of the Great Western Railway (London) Golfing Society.

Mr. W. J. Evans, Chief Boiler Inspector at Swindon, Great Western Railway, retired at the end of last week. Before joining the Great Western Railway, he was for 12 years foreman boilermaker at the Danygraig (Swansea) works of the former Rhondda & Swansea Bay Railway. Mr. Evans was the first conductor of the G.W.R. Swindon male voice choir.

Herr Munck, Chief Mechanical Engineer of the Danish State Railways, will retire on February 28, having completed his 65th year. After his college studies he entered the service of the well-known shipbuilders, Burmeister & Wain, in 1896 and went in 1909 to the Copenhagen Shipbuilding Company, becoming Manager in 1914. He received the appointment he is about to relinquish in 1927. His long experience, beginning in 1912, with diesel engines for marine service was very useful to him when introducing the railcar services on the Danish railways. The electrification of the Copenhagen suburban lines was also begun under his supervision.

Mr. John Williamson Lewis, who, as recorded in our issue of December 17 last, has been appointed Chief Engineer, Way and Works, Federated Malay States Railways, was born in 1887, and educated at King's School, Canterbury, and the Crystal Palace School of Engineering. In 1908 he became Extra Assistant Engineer, Chief Engineer's Office, Surrey Commercial Docks, London. He went to Malaya in May, 1909, on his appointment as Junior

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Assistant Engineer, F.M.S. Railways, and was employed on railway surveys and construction. Becoming Assistant Engineer in January, 1912, he was engaged on special service works in Kuala Lumpur. Mr. Lewis was given charge of a district of the F.M.S. Railways as District Engineer in March, 1913, and in November, 1923, was promoted Senior District Engineer and attached to Head Office. From June, 1931, to March, 1932, he acted as Engineer for Way and Works, and in August, 1932, was appointed Maintenance and New Works Engineer. Mr. Lewis has already acted as Chief Engineer, Way and Works, from October, 1934, to June, 1935. He was permanently appointed to that position on August 23, 1937. Mr. Lewis is an Associate Member of the Institution of Civil Engineers.

Mr. J. W. Lewis

Appointed Chief Engineer, Way and Works, Federated Malay States Railways

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Mr. S. R. Jones, who retired on February 4 from the post of Works Manager, Caerphilly, Great Western Railway, entered the service of the company as an apprentice at Swindon in 1887. In 1906 he was appointed Foreman, and from 1912 was in charge of "R" Shop, Swindon loco. works. During the war Mr. Jones was responsible for the guns made at Swindon; some 230 were completed, and approximately 1,000 rifles for various firms. In July, 1924, he was appointed Works Manager at Caerphilly, and was responsible for building up the new engine repairing shops, introducing a progressing system that would take in all the various types of tank engines of the G.W.R. and its constituent companies, acquired when grouping took place. Full details and illustrations of the system were published in *The Railway Engineer* for August, 1930. Caerphilly is now one of the most up-to-date engine repair depots in the British Isles. Mr. Jones is succeeded by Mr. William Matthews.

Mr. Joshua Shaw, M.Inst.C.E., M.I.Mech.E., M.I.E.E., General Manager, Engineer, and Secretary of the Mersey Railway Company, will retire on February 23. Mr. Shaw was educated at the Central School and Owens College, Manchester, and joined the engineering firm of Mather & Platt Limited as an apprentice in 1887. He was appointed Engineer of the Isle of Man Tramways in 1894; General Manager, Engineer, and Secretary of the Isle of Man Electric Tramways in 1899; and Consulting Tramways Engineer, Douglas Corporation, in 1902. It was in the latter year, also, that he joined the Mersey Railway as Engineer, to superintend the conversion from steam to electric traction then in progress. Mr. Shaw was appointed General Manager, Engineer, and Secretary of the company in 1908. His 36 years with the Mersey Railway thus began with one important milestone in its history—the electrification already referred to—and have concluded with another major development in the shape of the conversion of the line to the present standards for third-rail systems, in readiness for the forthcoming through working of L.M.S.R. trains to and from that company's Wirral lines, now being electrified. He also witnessed the jubilee of the Mersey Railway in 1936 (see THE RAILWAY GAZETTE of January 31, 1936). Mr. Shaw's career is further referred to in an editorial note on page 289. His appointment to the board of the Mersey Railway Company is to be recommended at the general

Mr. S. R. Jones

Works Manager, Caerphilly, G.W.R. 1924-38

Mr. Joshua Shaw

General Manager, Engineer, and Secretary, Mersey Railway, 1908-38

The late Ing. Arturo Caprotti

Originator of the Caprotti valve gear for locomotives and other steam engines

meeting of the company on February 24.

Mr. Robert Varley, Assistant to the General Manager and Engineer, has been appointed Acting General Manager and Engineer in Mr. Shaw's place, and Mr. J. E. Blacklin, Accountant and Assistant to the Secretary, will become Secretary and Accountant of the company.

We regret to learn of the death, at the age of 60, of Mr. Oscar Denzler, former General Manager of the Swiss Locomotive and Machine Works at Winterthur and a member of the Administrative Board of the Swiss Federal Railways.

Mr. A. B. Purvis has been elected to fill the vacancy on the directorate of the Canadian Pacific Railway Company caused by resignation of Mr. J. W. McConnell. Mr. J. W. McConnell relinquished his directorship of the C.P.R. and other important Canadian companies when, on the death of Lord Atholstan, he assumed the proprietorship and active direction of the *Montreal Star*. Mr. A. B. Purvis is President and Managing Director of Canadian Industries Limited, and Vice-President and Director of Barclays Bank (Canada) Limited. The son of William Blaikie Purvis, of Perth, Scotland, he was born in London.

We regret to record the death on February 10, at the age of 85, of Mr. Thomas Stewart Rome, a former Chairman of the Mersey Docks and Harbour Board and Director of the Liverpool Overhead Railway. Mr. Rome joined the Docks and Harbour Board in 1893, and became its Chairman in 1919, by which time he had served on a number of its committees. From 1921-24 Mr. Rome was Vice-President of the Dock and Harbour Authorities' Association, and President of the body in 1925. Mr. Rome resigned the chairmanship of the Mersey Docks and Harbour Board in 1927, but remained a member of the board.

The late Ing. A. Caprotti, whose death in Milan on February 9 was recorded in our issue last week, was born in Moscazzano (Province Cremona) on March 22, 1881. He studied engineering in Pavia and Turin where he obtained his degree in the year 1904. Subsequently he devoted himself to various activities in engineering but very soon concentrated on mechanical engineering, and in particular took great interest in the improvement of reciprocating steam engines. After several years of research work he developed the well-known type of poppet valve gear for locomotives and other reciprocating steam engines which has made his name famous all over the world. The first application of this valve gear was made in the year 1920, on a 2-8-0 goods locomotive of the Italian State Railways. Since then he devoted all his time to the development and improvement of his valve gear, which has since been adopted by a great number of railways in many countries. Ing. A. Caprotti was a member of the Institution of Mechanical Engineers, and of the Institution of Locomotive Engineers.

Señor Manuel R. Alvarado has been appointed Minister of Public Works in the new Argentine Cabinet, which, with Dr. Ortiz as President, will take office on February 20.

Mr. William Charles Warren, whose appointment as Chief Fire Superintendent, L.M.S.R., we recorded last week, received the King's Police Medal, for distinguished service, at Buckingham Palace on Tuesday. Mr. Warren has had over 30 years' service in the London Fire Brigade, where until the beginning of this year he was Senior Superintendent.

We regret to record the recent death of Mr. A. Jackson, of Sligo, in his 85th year. Mr. Jackson was a Director of the former Midland Great Western Railway, and up to a few years ago of the Great Southern Railways. He was also a Director of the Sligo Steam Navigation and various other companies. For some years Mr. Jackson was a member of the Irish Free State Senate, and he was a Deputy Lieutenant for Sligo.

The C.N.R. and Canadian Development

Mr. S. J. Hungerford, Chairman and President of the Canadian National Railways, illustrated the importance of the system to the development of Canada when speaking as the principal guest at the banquet of the Halifax Board of Trade on January 26.

As evidence of the contribution of the C.N.R. to the prosperity of the Maritime provinces, Mr. Hungerford mentioned that purchases by the system in that territory during 1937 amounted to something more than £3¼ million. Wage payments to employees on these Eastern lines came to nearly £3 million, and the gross earnings were just under £5 million. Accelerated train services assisted business by allowing more time for its transaction, in which connection Mr. Hungerford forecast an additional summer train to do the local work of the Ocean Limited between Montreal and Campbellton, N.B., making possible a cut of one hour in the running time of the latter, between Halifax and Montreal.

Measured by the ton-miles of railway freight service performed per head of the population, Canadians were the world's greatest users of transportation. Canada was going to grow. It was practicaliy the railway builder's pick that had uncovered the great cobalt deposits and the enormous nickel treasure of Sudbury which led to the present vast mining developments in the northern area. Construction was now being completed of a line 100 miles in length between Rouyn and Senneterre to serve a richly mineralised area in Quebec.

Looking into the future, Mr. Hungerford recalled that in 1928 the Canadian National system had net revenues of over £11 million. Few doubted the productivity of Canada would again reach the levels of 10 years ago. What had been would be again, and in greater measure.

L.M.S.R. London District Goods Manager's Smoking Concert

Mr. A. L. Castleman, London District Goods Manager, L.M.S.R., occupied the chair at the L.M.S.R. London District Goods Manager's annual smoking concert which was held at the Queen's Hall on Monday, February 14.

He was supported by: Mr. G. W. Galloway (Asst. District Goods Manager); Mr. W. O. Davies (Commercial Assistant); Mr. E. Overend (Operating Assistant); Mr. M. Hewitt (Cartage Assistant). Officers of the company present included Sir Harold Hartley, Messrs. C. E. Fairburn, W. E. C. Lazenby, H. V. Mosley, G. Morton, W. A. Stanier, T. W. Royle. Others present included Messrs. H. J. Hoskins (G.W.R.); A. Gregory, P. Syder (L.N.E.R.); E. E. Young (Southern Railway); F. Tipton and J. R. Smith (Thames Steam Tug & Lighterage Company); F. Edmeades and R. H. Lambert (Union Lighterage Company), and representatives of most of the important trading concerns in London.

There were no speeches, but a fifteen minutes' interval in the musical programme gave those present the opportunity of circulating and greeting their friends. The artists included: Garda Hall, Soprano; Gladys Knight, Contralto; Arnold Matters, Baritone; Mario Lorenzi, Harpist; Jack Warner and his Pianist, Entertainers; Marriott Edgar, Humorous; Cecil Johnson, Humorous; Rex Rashley, Humorous; Emile Philippe, Accompanist, and Percy Tapp, Organist.

Western China-Soviet Russia Railway

A Reuters message from Tokyo states that further details of the scheme to link Chungking, the new Chinese capital, with the Soviet Union by a 2,500-mile railway are given in messages from Japanese sources in Hong Kong. All materials for the railway are to be supplied to China by the Soviet Union in the form of a loan, bearing interest at the rate of 4 per cent. per annum redeemable within 20 years after the termination of the present hostilities. The railway would traverse Chinghai (formerly Kokonor) and Sinkiang (Chinese Turkestan). Reports from Chinese sources in Shanghai indicate that the purpose of the railway is to facilitate the transportation of military supplies from Europe to China. The occupation of the Lung-Hai Railway by the Japanese forces would appear to rule out the feasibility of any such scheme.

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STAFF AND LABOUR MATTERS

Railway Wages

At a special delegate conference of the Railway Clerks' Association held in London on February 13, new demands covering salaries and conditions for railway clerks were drawn up for presentation to the railway companies. The new demands include proposals for: (1) A 40-hour week; (2) Increase of £20 per annum for all male clerks of 25 years and over who are on or above the maximum salary for class 5 (the lowest grade) with similar improvements for women clerks, stationmasters, and supervisors, and improvements for the Railway Clearing House Staff; (3) The allowance of £10 a year for working in London to apply to an area of fifteen miles from Charing Cross instead of ten miles; (4) Time worked between 10.0 p.m. and 4.0 a.m. to carry the same extra payment as is received by the wages grade, *i.e.*, time-and-a-quarter. (The Conference decided that this item should be pressed even should it involve giving up the one night off in fifteen awarded by the Railway Staff National Tribunal in August last); (5) Improvements in holidays so as to give 15 days' holiday after 20 years' service and 18 days after 30 years; and (6) Staff described as unappointed clerks to be placed on the salaried staff and be given all the conditions of the salaried grades. It is understood that the Railway Clerks' Association will not make any move to approach the railway companies before consultation with the other two railway trade unions.

[*We comment on this in an editorial note on page* 290.—Ed. *R.G.*]

Road Transport—Wages

At a recent meeting of the National Joint Conciliation Board for the Road Motor Transport Industry (Goods) new proposals concerning wages and conditions were put forward from the employees' side. The proposals which are put forward on the grounds of increased cost of living, are for an increase of 6s. a week for adults and 4s. a week for juniors. The proposals are also understood to include a suggestion that the cumulative 48-hour week should be abolished and replaced by a system under which each day would be considered separately for wages purposes. The national board is understood to have referred the proposals to a sub-committee for consideration. It is understood that the employers take exception to the claim on the grounds that apart from any question as to merits, negotiations should not take place until legislation resulting from the Baillie Report on the Regulation of Wages and Conditions has been introduced, and until the new regulation machinery recommended by the Baillie Committee has been set up. An anomalous feature of the position is the generally admitted fact that the very wages scales to which it is proposed that the suggested increases should be added are not being universally adhered to by operators in the industry.

Steel Workers' Holidays

A report advocating paid holidays as from this year for over 40,000 men in the heavy steel industry was issued on February 10 by the sub-committee of the central joint committee representing the Iron and Steel Trades Employers' Association and the Iron and Steel Trades Confederation. It is to be discussed by over eighty branches of the confederation in England, Scotland, and Wales, and their recommendations will be reviewed by the executive committee in London on February 25. The report, after stating that the question of pensions for aged workers shall stand over for the present, recommends eleven working days' paid holiday in each year between mid-April and mid-October, and two holidays at Christmas or the New Year, or, alternatively, one day at Christmas and one in the New Year. A worker dismissed for misconduct should not receive holiday payment, but if he left of his own accord or was discharged for any reason other than misconduct he should receive his proportion of any holiday payment which might have accrued.

Wage Deductions for Meals

A judgment which may have a far reaching effect was given by Mr. Justice Wrottesley in the King's Bench Division on February 12 when he decided that a man was entitled to recover from his former employers in respect of deductions from his weekly wages for meals, which he alleged had been made in breach of the Truck Act, 1831. The plaintiff sued his former employers to recover £397 10s. which, he said, represented a deduction of 10s. a week from his wages from March, 1920, to December, 1935. The 10s. from his wages, the plaintiff asserted, was deducted for dinner and tea. In December, 1935, the system of providing meals was stopped and from that time he received the additional 10s. in cash until he retired from the company's employment. Mr. Justice Wrottesley entered judgment for the plaintiff for the amount claimed, with costs. He granted the defendants a stay of execution on the usual terms, in view of an appeal.

Retirement of G.W.R. Engine Drivers

Mr. Justice Porter in the King's Bench Division gave his reserved judgment on February 15 in an action brought by an engine driver, employed by the G.W.R., who claimed damages for alleged breach of contract, which was denied. The engine driver was transferred to the Great Western Railway when the Rhymney Railway Company, by which he was then employed, was amalgamated with it. He claimed that under an agreement of November, 1927, he could not be pensioned until he was 65 except for ill-health or similar special circumstances. The company pensioned him at the age of 62 years 6 months on the grounds of redundancy. He claimed for loss of wages through not being permitted to work until he was 65. Mr. Justice Porter found in favour of the company, and dismissed the action, allowing the company half its costs.

Southern Railway Steamer Traffic.—The Southern Railway steamers carried over 4½ million passengers by day and night services during 1937. Cross-Channel passengers to the Continent totalled 1,654,137, an increase of 42·1 per cent. over 1936, whilst freight traffic amounted to 229,704 tons, an increase of 22·7 per cent. Passengers to and from the Isle of Wight totalled 2,777,687, an increase of 8·1 per cent. Nearly 57,000 motorcars were carried by the company's steamers, including 30,645 by cross-Channel vessels, an increase of 67·6 per cent. over the previous record total of 1936. To and from the Isle of Wight, 25,976 motorcars were conveyed, an increase of 8 per cent. The Dover-Dunkerque train-ferry service conveyed during 1937 over 73,000 passengers, 60,000 tons of cargo, and 1,600 motorcars. Southern Railway vessels on all routes covered a total mileage of 667,000 during the year, an average of 1,900 miles a day.

G.W.R. Ambulance Awards at Shrewsbury.—At the annual dinner held at Shrewsbury on February 4, ambulance awards gained by members of the various classes in the Chester Division of the Great Western Railway, and educational certificates, were distributed. Mr. J. R. Morris, Divisional Superintendent, Chester, presided over the function, and was supported by :—

Dr. F. H. Edwards, Shrewsbury; Messrs. D. Blee, District Goods Manager, Shrewsbury; G. Cornish, District Goods Manager, Liverpool; J. W. Enser, District Traffic Manager, Oswestry; T. Martin, former District Goods Manager, Liverpool; R. E. Lampitt, Assistant Divisional Superintendent, Chester; H. H. Bird, Assistant Divisional Engineer, Shrewsbury; N. H. Briant, Chief Clerk, Chester D.S.O.; and G. Penney, Office of Superintendent of the Line.

The Chairman referred to the large number of gold efficiency medals gained by ambulance workers in the divisions and to the progress made in the movement. These efficiency medals and bars were presented by Mr. Martin, who also distributed first aid examination awards and certificates for the signalling course. Mr. Blee made the presentations of certificates for goods rates and station working, station accountancy, and salesmanship. Mr. J. H. Abrahams (Ambulance Class Secretary), who had given 35 years' service to the movement, received from the Chairman a silver cigarette case on behalf of the class. An enjoyable musical programme was provided.

Indian Railways Report for 1936-37

From our special correspondent

The annual report of the Railway Board on the working of the Indian railways during the twelve months ended March 31, 1937, has recently been published. Trade revival during the year is reflected in a substantial increase in railway traffic, and the results for the year show that the Indian railways were well placed on the road to prosperity. The following comparative figures of passenger-miles and net ton-miles indicate the improvement in passenger and goods traffic :—

	Passenger-miles (in thousands)	Net ton-miles (in thousands)
1934-35 ...	16,987,135	19,547,067
1935-36 ...	17,353,294	19,773,126
1936-37 ...	17,436,677*	20,701,293†

*† Increases of 0·48 and 4·69 per cent. respectively over 1935-36

The report states that the improvement in earnings noticed in the last five or six weeks of 1935-36 continued in 1936-37, but from November, 1936, onwards the increase was particularly large. The gross traffic results for the year amounted to Rs. 95½ crores (£71·6 million), or nearly Rs. 4¾ crores (£3½ million) more than in the previous year.

Ordinary working expenses, excluding depreciation, amounted to about Rs. 50¼ crores (£3¾ million), or about Rs. 66 lakhs (£495,000) less than in 1935-36. The contribution to the Depreciation Fund set apart from railway revenue was Rs. 13·15 crores, being Rs. 10 lakhs less than in 1935-36. The total working expenses, including depreciation, were thus Rs. 63·37 crores against Rs. 64·12 crores in 1935-36.

The net revenue for the year was Rs. 32·02 crores (£24 million) against Rs. 27·40 crores (£20½ million) in 1935-36. This sum was in excess of the interest charges for the year by Rs. 121 lakhs (over £900,000). The surplus was added to the Depreciation Fund in part-payment of the amounts withdrawn from that fund to meet deficits in the working of railways in previous years.

The total works expenditure during the year amounted to Rs. 8·16 crores, of which a sum of Rs. 28 lakhs was charged to capital and the balance to the Depreciation Fund. Open line works absorbed almost the whole of the capital expenditure, only a small sum of Rs. 20,000 being spent on new construction.

Operating Ratio and Reduced Expenditure

Discussing the substantial reduction in working expenses, the report compares the operating ratio on Indian railways with those on railways abroad. In India, the operating ratio for 1936-37 was 51 per cent., excluding depreciation, and 65 per cent., including depreciation. The British railways had an operating ratio of 81 per cent. ; Canadian Pacific and National Railways, 83·25 per cent. and 92 per cent. ; U.S.A. railways, 72·33 per cent. ; and German railways, 88·16 per cent.

With the exception of the Bengal-Nagpur railway, which showed a decrease of Rs. 26 lakhs on account of prolonged strikes, all Indian railways recorded an improvement in earnings. The receipts on the commercial sections of the North Western Railway and the Bombay, Baroda and Central India Railway even exceeded the figures for 1929-30, the last year of prosperity. The major increases in receipts, as compared with the previous year, are shown below :—

N.W.R.	158 lakhs	increase
G.I.P.	87 ,,	,,
E.I.R.	83 ,,	,,
B.B. & C.I. ...	81 ,,	,,
E.B.R.	48 ,,	,,

On the North Western Railway, both passenger and goods traffic contributed to the increased earnings. Though there was a small increase in passenger fares from January 1, 1936, the improved passenger receipts were largely due to the exceptional pilgrim traffic on the occasion of the Solar Eclipse Mela at Kurukshetra in June, 1936, and to the general development of traffic consequent upon improved trade conditions. Some improvement in coaching earnings was also made on the Eastern Bengal Railway due to the reduction in the basic fares of single and ordinary return intermediate class tickets, the introduction of week-end return tickets, and the issue of " travel-as-you-like " season tickets on special occasions. The number of passengers carried during the year under review increased by over 6 millions to 509·9 millions, but there was a decrease of about Rs. 23 lakhs in passenger receipts.

Special Measures to Improve Efficiency and Earnings

A chapter in the report on " Steps taken to improve earnings and reduce working expenses," briefly describes numerous activities on various railways. Among these may be mentioned, cheap fares in competitive areas and special reductions in freight rates ; street collection and delivery of parcels and goods in some of the larger towns, additional out-agencies, and the issue of rail-cum-road tickets ; research organisations to encourage and develop new traffic and prevent diversions ; detection of cases of misdeclaration and underweight of goods ; and the pooling of railway resources at certain joint stations. Efforts made on the Moradabad Division of the East Indian Railway to extend the run of goods engines resulted in a saving of eight engines.

The activities of the railways towards the provision of better amenities for passengers are also mentioned in the report. Alterations were made in train services to meet the changing demands of passenger traffic, and special express and ordinary trains were introduced or extended. The Frontier Mail from Bombay to Delhi was speeded up by 49 minutes. The Madras suburban service was re-arranged to provide quicker transport between Madras and suburban stations. The maximum permissible speed on the double line between Madras and Arkonam was increased from 60 to 70 m.p.h., and the railway service was accelerated wherever possible. Additional flag stations were opened for passenger and parcels traffic on various railways.

Road Competition, Air-Conditioning and Refrigeration

Remarking that road competition was intensified owing chiefly to gross overloading of motor lorries and to a flagrant evasion of the motor vehicles rules, the report reviews in brief the steps taken by different railways to meet this competition.

After referring to the proposed introduction of air-conditioned coaches as an experimental measure, the report states that the Railway Board visualises the possibilities of the development of refrigerated traffic in India if necessary transport facilities are provided. An experimental refrigerator van with mechanical equipment was under construction on the Madras and Southern Mahratta Railway. Other railways would provide similar vans if and when the traffic offering justified them.

Total Capital, also Results during Last Thirteen Years

At the end of March, 1937, the total capital at charge on all railways amounted to Rs. 880·13 crores, of which a sum of Rs. 789·03 crores represented the capital at charge on State-owned railways, and the balance of Rs. 91·10 crores capital raised by Indian States, companies, and district boards.

The report includes an interesting review of the financial results of the railways during the last 13 years. The table below shows the profit or loss to the Government on each of the Class I railways during this period :—

Profit +		Loss −	
E.I.R.	+ Rs. 19·33 crores.	N.W.R. (strategic) ...	− Rs. 24·50 crores.
B.B. & C.I.	+ 18·25 ,,	B.-N.R.	− 16·66 ,,
S.I.R.	+ 6·25 ,,	A.-B.R.	− 5·33 ,,
B.N.W.R. (Tirhoot) ...	+ 6·00 ,,	E.B.R.	− 5·00 ,,
M. & S.M.R.	+ 5·00 ,,	Burma R.	− 2·00 ,,
N.W.R. (commercial) ...	+ 1·75 ,,	G.I.P.R.	− 1·50 ,,
Lucknow-Bareilly R. ...	+ 1·00 ,,		
	+ 57·58 ,,		− 54·99 ,,

Net Profit, Rs. 2·59 crores.

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The Longest Non-Stop Runs in the World

Supplementing the article in the February 4 issue of THE RAILWAY GAZETTE on world speed developments on railways in 1937, the annexed table shows the longest non-stop runs performed regularly on rails. It is of interest that here Great Britain enjoys an undisputed pre-eminence; during the summer months the eight longest non-stop runs in the world are performed in this country, and during the winter the four longest; this British lead, furthermore, is a lead for steam, as all the British runs tabulated are with steam propulsion. They are headed by the summer journey of the L.N.E.R. Flying Scotsman, 392·7 miles, which is the only one of the series requiring the provision of a corridor tender to permit of changing the engine-crew *en route*. On only four occasions in railway history has this distance been exceeded with steam propulsion, even on experimental journeys; these experiments were made by the L.M.S.R., which on a day in June, 1928, divided the down Royal Scot, and ran the two portions non-stop from Euston to Glasgow, 401·4 miles, and Edinburgh, 399·1 miles, respectively, and again in November, 1936, made the remarkable experimental journey with the 4-6-2 locomotive *Princess Elizabeth*, from Euston to Glasgow and back, non-stop in each direction, and completing the Glasgow—Euston run at an average of exactly 70 m.p.h. throughout. Second on the list come the Euston—Carlisle runs of the L.M.S.R., four times daily in summer and three times daily in winter, which with their 299·1 miles of distance are for nine months in the year the longest daily non-stop runs in the world. Two of these—the 63·4 m.p.h. runs of the Coronation Scot—were 1937 innovations, as was also the 67·9 m.p.h. journey of the L.N.E.R. Coronation from Newcastle to King's Cross, 268·3 miles in length and next on the list. It is only at the height of the summer season that the 263·6-mile non-stop journey of the L.M.S.R. between Euston and Holyhead is made daily.

With diesel power the longest daily run is that of the Burlington Company's Denver Zephyr over the 254·4 miles in each direction between Denver and McCook. It was a section of this train with which the longest non-stop railway run in history was performed, as immediately prior to the introduction of the present twelve-car unit in regular service, the twin power cars with six passenger coaches out of the set, eight cars in all, were run without a stop over the 1,017 miles from Chicago to Denver at an average speed of 83·3 m.p.h. throughout. Various other very lengthy runs of diesel-electric trains appear in the American timetables, but in all cases are performed not more than twice in each week, and in certain cases it is probable that operating stops are included; these are the 324·5-mile journeys of the City of Los Angeles over the Union Pacific between Salt Lake City and Caliente (61·4 m.p.h.); the 288·3-mile runs of the City of San Francisco over the Southern Pacific between Carlin and Sparks (69·1 m.p.h.); the 234·6-mile run of the Santa Fé Super-Chief from Chicago to Shopton at 66·4 m.p.h., followed by the 216·5 miles on to Kansas City at 64·9 m.p.h., while the same train is booked over the 202·4 miles between Dodge City and La Junta non-stop, eastbound at 78·3 m.p.h. and westbound at 74·0 m.p.h. Elsewhere the longest diesel train journeys without stop are in Germany, between Berlin and Breslau, 204·7 miles, at 76·8 m.p.h., and over the heavily-graded 200·1 miles through the Thuringian Forest between Leipzig and Nuremberg.

Electricity first appears on the list with the 249·1-mile journey of the Barcelona Express over Paris—Orleans—Midi metals from Paris to Limoges; the only other lengthy electric runs are those of the Italian State Railways over the 196·5 miles between Rome and Florence, nine in number daily. Several of these, including the run of the high-speed unit in each direction, were of 1937 introduction, and the same applies to the 234·3-mile run of the L.M.S.R. Ulster Express from Euston to Morecambe. The fastest start-to-stop runs in this table with steam are those of the L.N.E.R. Silver Jubilee, at 70·4 m.p.h. over the 232·3 miles between King's Cross and Darlington. The 243·3-mile run of the

THE LONGEST NON-STOP RUNS IN THE WORLD, 1937

Country	Railway	Between	Distance	No. of Runs Daily		Fastest Train	Fastest		Fastest Service	
				Summer	Winter		Time	Speed	Name	Propulsion
			miles				h. m.	m.p.h.		
Great Britain	L.N.E.R.	King's Cross–Edinburgh	392·7	2	—	10.00 a.m. D. 10.00 a.m. U.	7 00	56·1	Flying Scotsman	Steam.
,,	L.M.S.R.	Euston–Carlisle	299·1	4	3	1.30 p.m. D. 3.17 p.m. U.	4 43	63·4	Coronation Scot	,,
,,	L.N.E.R.	Newcastle–King's Cross	268·3	1	1	6.33 p.m. U.	3 57	67·9	Coronation	,,
,,	L.M.S.R.	Euston–Holyhead	263·6	*1	—	†8.30 a.m. D.	5 05	51·9	Irish Mail	,,
United States	Burlington	Denver–McCook	254·4	2	2	4.00 p.m. E.	3 28	73·4	Denver Zephyr	Diesel.
France	P.O.-Midi	Paris (Austerlitz)–Limoges	249·1	1	1	8.30 p.m. D.	4 08	60·2	Barcelona Express	Electric.
Great Britain	L.M.S.R.	Glasgow–Crewe	243·3	1	1	10.45 p.m. U.	5 05	47·9	Night Scot	Steam.
,,	L.M.S.R.	Euston–Morecambe	234·3	1	1	7.00 p.m. D.	4 12	55·8	Ulster Express	,,
,,	L.N.E.R.	King's Cross–Darlington	232·3	2	2	5.30 p.m. D. 10.42 a.m. U.	3 18	70·4	Silver Jubilee	,,
France	Northern	Paris–Liége	226·7	2	2	7.15 p.m. D.	3 56	57·6	Nord Express	,,
Great Britain	G.W.R.	Paddington–Plymouth	225·5	1	1	‡12.50 a.m. D.	4 00	56·4	—	,,
France	Eastern	Paris–Nancy	219·0	2	2	9.09 a.m. U.	3 31	62·3	—	,,
Great Britain	L.M.S.R.	Crewe–Carstairs	214·6	1	—	10.32 p.m. D.	4 24	48·8	Royal Highlander	,,
,,	L.N.E.R.	York–Edinburgh	205·5	1	1	6.40 p.m. D.	3 20	61·7	Coronation	,,
,,	L.M.S.R.	Euston–Prestatyn	205·5	1	—	11.15 a.m. D.	3 50	53·6	Welshman	,,
Germany	State	Berlin (Sches.)–Breslau	204·7	2	2	8.06 p.m. D.	2 40	76·8	—	Diesel.
,,	State	Leipzig–Nuremberg	200·1	2	2	8.29 a.m. U.	3 33	56·4	Fliegende Münchener	,,
Italy	State	Rome–Florence	196·5	9	9	12.25 p.m. D. 4.50 p.m. U.	3 10	62·1	—	Electric.
Great Britain	G.W.R.	Paddington–Newton Abbot§	193·7	2	—	10.30 a.m. D.	3 13	60·2	Cornish Riviera Limited	Steam.
France	Northern	Paris–Brussels	193·1	4	4	6.10 p.m. D. 10.47 a.m. U.	3 00	64·4	Blue Bird	,,

Notes:—* Daily during height of summer season only. † On Saturdays only. ‡ Newspaper Train. § Stop to attach or detach bank engine.

L.M.S.R. from Glasgow to Crewe derives interest from the fact that during its course the train has to be lifted over both Beattock and Shap summits, respectively 1,015 and 915 ft. above the sea, with a drop intermediately to sea level north of Carlisle; the same applies to the summer journey of the Royal Highlander from Crewe to Carstairs. The G.W.R. Paddington—Plymouth run of 225·5 miles, which for many years after its introduction in 1904 was the longest non-stop run in the world, now takes eighteenth place in summer and fourteenth in winter; further, it is no longer made by the Cornish Riviera Limited, with which it originated, for even in summer, when that train is nominally non-stop between Paddington and North Road, a stop is scheduled daily at Newton Abbot in each direction for banking assistance over the heavy grades between Newton and Plymouth. Of the 27 daily runs in summer over 200 miles without a stop, 16 are British; in winter Great Britain claims ten out of a total of 21. In all, the 1937 summer timetables showed 180 daily non-stop runs of over 100 miles in length on British railways, as compared with 156 in 1936, and 229 over 90 miles in length, compared with 203 in 1936, and 175 in 1914, before the war.

Of the runs of 100 miles and over, the L.M.S.R. claimed 82, the L.N.E.R. 66, the G.W.R. 30, and the S.R. 2; of 150 miles in length and over there were 38 daily on the L.M.S.R., 15 on the L.N.E.R., and 7 on the G.W.R.

Southern Electrification Progress

Chichester group of lines to be opened in July—Ascot group well in hand—Work begun on West Kent Lines—Hastings *via* Tunbridge Wells project deferred

In addition to recording that full electric services on the Portsmouth Direct line were begun on July 4 last, the annual report of the Southern Railway for 1937 outlines the progress of the various other conversion schemes now being undertaken. Work is actively in hand on the following sections of line: Dorking North and Three Bridges to Havant; Havant to West Worthing; the Bognor Regis and Littlehampton branches; Virginia Water to Reading *via* Ascot; Ascot to Ash Vale junction; Frimley to Pirbright junction; and Aldershot North junc. to Guildford.

These lines are, of course, in two groups. Those in Sussex are sufficiently far advanced to enable the announcement to be made that electric services will be brought into operation next July between London and Portsmouth Harbour *via* Chichester; on the Bognor and Littlehampton routes; and also between Brighton and Portsmouth. Electrification has been started on a further group, namely, the Kentish lines from Gravesend Central to Maidstone West; Swanley Junction to Gillingham; Strood to Rochester; and Otford to Maidstone East. A full-page map of the lines affected was published on page 1239 of our Electric Traction Supplement for June 25 last.

Subsequent to the publication of the report, however, it was learned that, after careful consideration, the directors of the Southern Railway have decided that the present time is not opportune to proceed with the electrification project from Sevenoaks to Hastings *via* Tunbridge Wells, referred to as the Hastings No. 2 project, for the following reasons. It will be remembered that in 1935 under the Railways (Agreement) Act the Government evolved a scheme to make available to the Railways cheap money to enable them to carry out works which would otherwise not have been undertaken immediately; the object being to relieve unemployment. Scheduled to the Railways (Agreement) Act was the list of works which each company had suggested undertaking and completing by the end of 1940. One of the works included in the Southern Railway schedule under this plan was Hastings No. 2.

Of the works put forward in the Southern Railway schedule Hastings No. 2 always appeared the least financially attractive owing to two factors, namely, (*a*) The restricted loading gauge on this line necessitating special new electrical rolling stock of different dimensions from that used elsewhere on the system (this is already the case with the steam trains now running); and (*b*) The existence of an alternative electrified route which would, as has now been proved to be the case, divert many passengers who once travelled by the direct route; electrification of the latter would probably bring them back without necessarily increasing the net revenue from traffic by both routes.

The inclusion of Hastings No. 2 in the Southern Railway schedule to the Act, moreover, was due partly to physical reasons. At the time it was thought expedient for purposes of continuity of work to carry out the Hastings No. 2 scheme whilst Swanley Junction station was being reconstructed for purposes of another subsequent electrification scheme. Since the Act of 1935, however, conditions have altered considerably by the diminution of unemployment. Cost of materials and labour have risen and continue to rise, and the economic aspect of certain schemes in the schedule, and more especially Hastings No. 2, is very much changed. The physical necessity, moreover, no longer exists, as other and quicker means of carrying out the work at Swanley have been found. These facts, therefore, have caused the directors to reach their decision, bearing in mind particularly that Hastings is served by electric trains by one route, whilst enjoying a main-line steam service by an alternative route. We learn, moreover, that the officers of the company are applying themselves energetically to the examination of the possibilities of still further improving the existing steam services.

Forthcoming Events

Feb. 18 (*Fri.*).—Institute of Transport (East Midlands), at Guildhall, Nottingham, 7 p.m. "Goods Station Terminal Working," by Mr. J. Kirkwood.

Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. 5.30 p.m. Annual General Meeting.

Feb. 19 (*Sat.*).—Stephenson Locomotive Society (Newcastle), at Central Y.M.C.A., 7.30 p.m. "A Railway Film Show," by Mr. W. Greenfield.

Feb. 21 (*Mon.*).—G.W.R. (Birmingham) Lecture and Debating Society, at Great Western Hotel, Snow Hill Station, 6.30 p.m. Essay Competition.

Institute of Transport (Scottish), at North British Station Hotel, Edinburgh, 7.15 p.m. "The Regulation of Street Traffic," by Mr. R. Beveridge.

Feb. 22 (*Tues.*).—Institute of Transport (Birmingham Graduate), at Chamber of Commerce, 6.30 p.m. "Railway Enterprise," by Mr. S. Lea.

Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. "Transport Publicity," by Mr. C. Dandridge.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 6.45 p.m. "Some Insights into Locomotive Running," by Mr. E. Trask.

Permanent Way Institution (Scottish), at Royal Technical College, George Street, Glasgow, 7.30 p.m. "Some Remarks on Canted Connections," by M. Frieze.

Feb. 23 (*Wed.*).—Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. Annual General Meeting. "Balancing and its Effects on the Locomotive and on the Bridges," by Mr. D. Brown.

Institution of Railway Signal Engineers, at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Annual General Meeting and Presidential Address.

Feb. 24 (*Thurs.*).—Institution of Structural Engineers (London), at Inst. Civil Engineers, Great George Street, S.W.1, 6.30 p.m. Joint Meeting with Inst. of Welding. "Regulations and Specifications for Welded Steelwork," by Mr. E. Gardner.

Feb. 25 (*Fri.*).—Institute of Transport (Manchester-Liverpool), at Exchange Station Hotel, Liverpool, 6.30 p.m. "Air Transport," by Mr. R. Carter.

Railway Students' Association (Edinburgh), at Goold Hall, St. Andrew Square, 7.30 p.m. "The Darlington Operating District," by Mr. T. Hare.

Feb. 26 (*Sat.*).—London Transport Military Band, at Kingsway Hall, Kingsway, W.C.2. Concert.

Mar. 1 (*Tues.*).—Great Eastern Mechanics Institution, Stratford, 8 p.m. "The Efficiency of the Locomotive Boiler," by Mr. P. Lewis-Dale.

Mar. 3 (*Thurs.*).—G.W.R. (London) Lecture and Debating Society, in General Meeting Room, Paddington Station, 5.45 p.m. Debate with Southern Railway Lecture and Debating Society.

Mar. 4 (*Fri.*).—Institute of Transport (London), at Connaught Rooms, Great Queen Street, W.C.2, 7 for 7.30 p.m. Annual Dinner.

Mar. 5 (*Sat.*).—Permanent Way Institution (Manchester-Liverpool), at Technical College, Liverpool, 3 p.m. "Permanent Way for High Speed," by Mr. W. A. Willox.

Mar. 23 (*Wed.*)—Railway Convalescent Homes, at Wharncliffe Rooms, Hotel Great Central, Marylebone, London, N.W.1, 6.15 for 6.45 p.m. Banquet.

XUM

RAILWAY AND OTHER REPORTS

Great Western Railway Company.—The Secretary writes, February 11: "The increase in gross receipts of the railway and ancillary businesses for the year 1937 compared with 1936 was £1,823,514. The increase in gross expenditure amounted to £1,281,624. The net revenue earned during the year amounted to £6,886,505, an increase of £571,676, which with the balance of £76,793 brought forward from last year amounts to £6,963,298. From this amount the directors have decided to transfer a sum of £100,000 to a New Works Revenue Suspense Account, and, after meeting the interest and dividends on the pre-ordinary stocks, there remains available for ordinary dividend £1,868,767. The directors recommend the payment of a dividend for the half-year ended December 31 of £3 10s. per cent. on the consolidated ordinary stock, making £4 per cent. for the year, leaving a balance to be carried forward of £151,578. The dividend warrants will be posted on the 2nd proximo."

Great Northern Railway (Ireland).—The Secretary writes, February 11: "I beg to inform you that, after transferring a sum of about £9,000 from reserves to the net revenue of the year ended December 31, 1937, and adding the balance of £1,448 brought forward from last account, my board has resolved to recommend to the proprietors the payment of a final dividend of £2 per cent. (less income tax) for the year 1937 on the consolidated 4 per cent. guaranteed stock. The directors regret that the net income has not been sufficient to permit of the payment of dividends on the preference and ordinary stocks."

London Midland & Scottish Railway Company.—The Secretary writes, February 11: "For the year 1937, the company's net revenue from all sources amounted to £14,356,000, showing an increase over 1936 of £308,000. Owing to 1936 being a leap year, the results for 1937 reflect one less working day. The 1937 results compared with those of 1936 are as follow:—

	Railway	Other Businesses, Interest, &c.	Total
	£	£	£
Increased receipts	2,771,000	367,000	3,138,000
Increased expenditure	2,387,000	443,000	2,830,000
Net revenue	+ 384,000	− 76,000	+ 308,000

Of the total increase in expenditure, approximately £1,875,000 (or 60 per cent. of the increased receipts) is due to increased prices of materials and rates of wages, and £955,000 (or 30 per cent. of the increased receipts) is due to the additional volume of business. With the balance of £79,000 brought forward from 1936, the amount available for interest and dividend on the company's stocks is £14,435,000. After meeting interest and dividends on the debenture, guaranteed, and preference stocks, amounting to £12,913,000, there is a balance of £1,522,000, and at a meeting of the board today it was decided to recommend the proprietors to declare a dividend on the ordinary stock of £1 10s. per cent., carrying forward £94,000. The warrants in respect of the dividends on the ordinary stock, together with those for the half year ended December 31, 1937, on the guaranteed 4 per cent. preference, and 4 per cent. preference (1923) stocks, will be posted on March 10."

London Midland & Scottish Stock Conversion Trust.—The trustees announce that out of the dividend to be received on the holding of L.M.S.R. ordinary stock, it is proposed to pay a dividend of £1 6s. 8d. per cent., less tax, on the 4 per cent. preference stock of the conversion trust.

Canadian Pacific Railway.—After the meeting of the board of directors on February 14, the following announcement was made: "Upon consideration of the results of the Canadian Pacific Railway Company's operations in 1937, and having in view its obligations as guarantor of the interest on certain securities of the Minneapolis, St. Paul, & Sault Ste Marie Railway Company, the directors have declared a dividend from the earnings of 1937 of 2 per cent. on the preference stock, payable April 1, 1938, to stockholders of record March 1, 1938."

Oldham, Ashton-under-Lyne, and Guide Bridge Junction Railway.—Gross receipts for the year 1937 were £22,945, against £21,053 in 1936, and expenditure increased by £3,948, to £30,061. Adding miscellaneous receipts and deducting miscellaneous charges, leaves a net revenue deficit of £5,822, compared with £4,155 in the previous period. The amount receivable under lease from the L.M.S.R. and L.N.E.R. was £7,722, against £6,055, leaving a balance available for dividend of £1,900, enabling a dividend of 4¾ per cent. to be paid on the £40,000 share capital held by the public. Total passenger train receipts were £8,962, as compared with £8,589 in 1936. The improvement was all in third class and workmen's tickets, and first class was less. Goods train receipts, at £13,329, were £1,433 higher.

National Provincial Bank Limited.—The directors report that after providing for rebate of discount on current bills and credits to contingency account, out of which provision for all bad and doubtful debts has been made, the net profit for the year 1937 amounts to £1,874,960; and adding £970,667 brought forward from last account, makes a total of £2,845,627, which has been appropriated as follows: interim dividend of 7½ per cent. subject to tax paid in July last, £710,956; a further dividend of 7½ per cent. subject to tax payable January 28, £710,956; reserve fund, £500,000; pension fund, £250,000; bank premises account, £100,000; and balance carried forward to 1938, £573,715. The total of branches and agencies now open is 1,324.

Railroad Credit Corporation.—The report to the Interstate Commerce Commission and participating carriers, to December 31, 1937, shows that accrued net income upon the fund administered under the plan for the calendar year 1937 amounted to $431,708. Pending completion of the working statements covering the allocation of such income to the several participating carriers it has been credited to a suspense account carried on the balance sheet under "Unadjusted Credits." It is expected that the notices of income allocated will be ready for mailing in about 30 or 40 days, at which time each carrier's proportion will be credited to its account in "Non-negotiable debt."

Manchester Ship Canal Company.—Gross receipts from the whole undertaking for 1937 increased by £138,220 to £2,019,135, and expenditure by £109,146 to £1,216,030, leaving net receipts £29,074 higher at £803,105. Gross receipts of the ship canal were £1,435,526 (against £1,339,479); of the Bridgewater canals, £194,087 (£184,226); and of the railways, £389,522 (£357,210). There was an increase of 79,908 tons in the weight of sea-borne traffic on which ship canal tolls were paid. New works undertaken during the year included an extension of the company's railways and private road serving the Stanlow oil sites, involving a reinforced concrete road-rail bridge over the River Gowry. Dividends of 3½ per cent. on the Manchester Ship Canal Corporation preference stock; of 4 per cent. on the preference shares; and of 2 per cent. on the ordinary shares, leave a carry forward of £31,701, compared with £31,952 in the previous year.

British South Africa Company.—At the annual general meeting on February 9, reference was made to the loan of over £270,000 made by the company to Rhodesia Railway Limited, in connection with their debenture conversion operation. The railways are all owned now by Rhodesia Railways Limited and the whole of the share capital of that company is held by the Rhodesia Railways Trust, of the share capital of which 80 per cent. is held by the British South Africa Company. The prosperity of the railways continues. Their net earnings for the year ended September 30, 1937, increased by £815,000 to nearly £2,000,000 so that after providing for all charges they show a surplus of nearly £917,000. There is every reason to hope that for the current year the reserve account will be equal to one year's service of the debentures which will enable them to pay a dividend. The latest figures for the period from October 1 to December 31, for gross receipts of all the railways, including the Beira and Shabani lines, continue to show increases, amounting for that period to £350,000 over the figure for the corresponding period in the previous year.

NOTES AND NEWS

G.W.R. and Electrification.—The Great Western Railway Company announces that, in view of the increasing cost of steam working, Messrs. Merz and McLellan, of 32, Victoria Street, Westminster, S.W., have been requested to prepare a scheme for the electrification of a part of the system. It is thought that the substitution of electric traction may enable considerable economies to be effected.

Renaming of Southern Railway Stations.—The Southern Railway announces that Tooting Junction station has been renamed Tooting; and West Moors, West Moors for Ferndown.

Roumanian Locomotives.—The Roumanian State Railways have just put into express passenger traffic on lines with medium grades a series of 2-8-4 locomotives built in Roumania at the Malaxa and Reschitza works. Hitherto Pacific engines have been the largest locomotives in use.

Improvements to Grimsby Coal Depôt.—Improvements are being carried out at the L.N.E.R. Holles Street coal depôt at Grimsby. A new roadway is being constructed in order to provide access for road vehicles to an increased number of wagons of coal in the depôt, and a new 20-ton weighbridge is also to be installed.

London-Glasgow Direct Air Service.—Railway Air Services Limited announces that it will this year operate a direct air service between London and Glasgow, *via* Liverpool, in addition to the Royal Mail London-Glasgow route, which goes *via* Belfast. The London-Glasgow direct service will probably be inaugurated to coincide with the opening of the Glasgow Empire Exhibition.

Isle of Man Air Services Limited.—The report of the Isle of Man Steam Packet Co. Ltd. for 1937 records the amalgamation into one concern—Isle of Man Air Services Limited—of the air routes plying between the island and the mainland (see also THE RAILWAY GAZETTE of September 24, 1937). To the £75,000 capital of the new company the three parties concerned—the L.M.S.R., the Isle of Man Steam Packet Co. Ltd., and Olley Air Service Limited—have each contributed £25,000. The amalgamation was completed at the end of September, and the amount subscribed provides sufficient working capital and spare funds for future development.

L.N.E.R. Edinburgh Ambulance Competition.—The twenty-second annual ambulance competition for the Gordon Price Cup was held at Waverley station, Edinburgh, on February 6. Seven teams took part, and the cup was won by No. 1 Team with 152½ points. No. 5 Team, with 150 points, was second. The cup and badges were presented by Mr. W. N. Kerr, Chief Assistant to the District Goods and Passenger Manager, L.N.E.R., Edinburgh. In making the presentation, Mr. Kerr congratulated the team and made reference to the ever-growing need for ambulance training.

Railway Accident in Brazil.—Fifteen persons are reported to have been killed and about a hundred injured in a railway accident near Goyaz, the chief town of the Brazilian State of the same name, on the borders of the swamps and forests of the Matto Grosso.

Address Change.—Airvac Limited, manufacturer and patentee of Airvac ventilators, has removed from Darlington to larger and more modern works at Abbeydale Road, Wembley, Middlesex, with sales offices and showrooms at 22, Newman Street, London, W.1.

"Institution of Electrical Engineers."—Exactly 50 years ago the council of the Society of Telegraph Engineers and Electricians announced its decision (subject to the approval of the members) to change the name of the society to the Institution of Electrical Engineers.

The Travelling Post Office in 1838.—According to the *Derby Mercury* of 100 years ago, "On Wednesday [February 7, 1838] the post-office clerks commenced travelling on the Birmingham railroad, and sorted the letters during the journey, so as to have them ready for delivery on their arrival." The history of the travelling post office was outlined in an editorial article in our issue of September 7, 1934.

Glasgow Underground Extension Proposed.—On the proposal of Councillor G. L. Campbell, the Glasgow Transport Committee has formed a special sub-committee to investigate the possibility of extending the underground railway as a means of relieving traffic congestion in the city. The estimated costs of alterations to be carried out at Glasgow underground stations are as follow: Partick Cross, £2,000; Kelvinbridge, £1,000 (including a new hoist); and Bridge Street, £600.

Names for St.Pancras-Manchester Expresses, L.M.S.R.—The L.M.S.R. announces that the 10.30 a.m. St. Pancras to Manchester express, together with its corresponding return train at 4.25 p.m. from Manchester, will be named The Peak Express, from the fact that the train passes between Derby and Manchester through the Peak District of Derbyshire. The 10 a.m. from Manchester to St. Pancras, and the corresponding return train from St. Pancras at 4.30 p.m., will be named The Palatine, after the County Palatine, Lancashire.

Cheap Fares for Leipzig Spring Fair.—In connection with the Leipzig Spring Fair, which will be held this year from March 6 to 14, the Southern Railway is issuing special reduced rate return tickets by its short sea routes. The third class return, *via* Dover-Ostend, is £4 5s. 5d. Membership certificates, issued by the London office of the fair (First Avenue House, High Holborn, W.C.1) must be produced at the time of booking. The reduced rate return tickets will be available for 19 days from the opening date.

Welding Developments in Germany.—On Monday next a small party of engineers is travelling to Berlin for the purpose of examining and discussing the latest welding developments in Germany. The expedition is sponsored by the British Oxygen Co. Ltd., and will include representatives of that company, the Quasi Arc Co. Ltd., the L.N.E.R., the L.M.S.R., the Southern Railway, and the Great Northern Railway (Ireland).

Reichsbahn Travel Office for Glasgow.—The German State Railway, which already has offices in most European and overseas capitals, has decided to open an information office in Glasgow in connection with this year's Empire Exhibition. The office, which will be at 140, West George Street, will be for information purposes only, and no actual sale of tickets, hotel reservations, or other bookings will take place. It is expected that the office will remain as a permanency after the closing of the exhibition.

Chinese Eastern Railway Purchase.—According to a Reuters message from Tokio, a Japanese banking syndicate has decided to underwrite a 50,000,000 yen (about £2,900,000) bond issue, to be made by the Government of Manchukuo in connection with the purchase of the Chinese Eastern Railway from the Soviet Union. This issue will form the last instalment of cash payments totalling 170,000,000 yen (£9,900,000), all of which have been underwritten by a Japanese banking syndicate.

Stann Creek Railway.—This line, 25 miles long and of 3-ft. gauge, the only railway in British Honduras, has been closed to traffic and is to be replaced by a road. In his address to the Legislative Council on October 19, 1937, the Officer administering the Government announced that the Secretary of State had approved in principle the replacement of the railway by a road and the building of a new pier at Stann Creek. The address was published in the *Gazette Extraordinary of British Honduras* of October 20, 1937.

Northern Ireland Transport Commission.—The Government of Northern Ireland is to set up a commission to investigate the operation of the Road and Railway Transport Act, under which the Northern Ireland Transport Board was set up on July 16, 1935. The report on the first year's working of the board disclosed a debit balance on revenue account of £71,583, and the railways, which had hoped for a contribution from the pooled rail and road transport receipts in respect of traffic diverted to the roads, received no payment but contributed £5,850. The commission will consist of three mem-

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bers, two of whom, it is expected, will be Sir Herbert Walker, formerly General Manager of the Southern Railway, and Sir William McLintock, the chartered accountant.

Debt Payment to Cuban Railways.—The Bill approved by the Cuban Senate for the issue of bonds to pay debts of $22 million dollars to the railways (see THE RAILWAY GAZETTE last week), was vetoed by the President, who requested the formation of a commission to study the railway debt situation. The veto, however, was overruled, and the Bill has also now passed the House of Representatives. It provides for a highway tax to raise funds for the bond issue.

Railway Business at Krupp's.—The report for the year ended September 30 of Krupp's of Essen records an increase in exports of 20 per cent. as a result of large contracts for locomotives and railway equipment, in particular to Argentina, India, Italy, China, Switzerland, Turkey, and South Africa. The assets of the firm stand at 575 million marks (£48 million), as compared with 389 million in 1932—an increase of 70 per cent. in five years. A profit of 16 million marks was recorded, compared with 14 million marks a year ago.

Reduction in Swiss Fares Contemplated.—The possibility of a general reduction in fares is at present being investigated, and discussions are taking place between the Federal and private railways in this connection. It is proposed that the basic rates should be reduced by about 25 per cent. second class, and 20 per cent. third class for single tickets, and for return by 30 and 25 per cent., respectively, and there would also be reductions in the express train supplements, but the present cheap week-end facilities would be withdrawn.

American Double-Deck Passenger Coaches.—The Pennsylvania Railroad has placed in service on its Long Island Railroad two new lightweight aluminium-alloy double-deck passenger vehicles of a type similar to the experimental coach described and illustrated in THE RAILWAY GAZETTE of September 23, 1932. One of the new coaches is equipped with four high-speed electric motors and the other serves as a trailer. Both are 80 ft. in length and have seating for 136 passengers. Their respective weights are 90,000 lb. and 80,000 lb. as against 114,000 lb. of the first coach with 120 seats.

Surplus of £2,000,000 in Revised Indian Railway Estimates.—The revised estimates for the Indian Railways for 1937/38 and the Budget Estimates for 1938/39 in respect of the Indian Railways were presented to both houses of the Central Legislature recently. The revised estimate shows a surplus of slightly over £2,000,000, while the second estimate shows a surplus of a little under £2,000,000. Traffic receipts for 1937/38 are expected to be £71,000,000, or £2,000,000 more than in the previous year. Working expenses, however, are expected to show an increase of £1,000,000. The capital programme during 1938/39 provides for £7,000,000 and includes the provision of £333,000 for three lines in Sind. The balance is for the improvement of open line facilities. Rolling stock is estimated to cost £3,333,000.

Extended G.W.R. Camp Coach Programme.—To meet the growing demand for camp coaches, the Great Western Railway is converting a further ten vehicles for use this season, giving a total of 60 coaches. In the 1934 season, when the first 19 coaches were introduced, 230 parties, equivalent to 800 persons, were accommodated. Last year fifty coaches were available and were let to 645 parties totalling approximately 3,000 persons. Coaches will this year be placed in the Severn Valley for the first time.

L.N.E.R. Camping Coaches.—The L.N.E.R. has arranged for 119 camping coaches and ten camping apartments to be available for the 1938 holiday season. The coaches will be stationed at various rural and seaside stations between Essex and the Western Highlands of Scotland, the sites including the Yorkshire Coast, the banks of Loch Lomond, the Cheviot Hills, Deeside, and the Scottish Border. Many have already been booked for Easter and August. A touring camping coach is also available, for making a week's tour of the Yorkshire dales and moors, starting and finishing at York. Camping accommodation is also available in certain country station buildings.

L.M.S.R. Caravan Coach Bookings.—Application to rent L.M.S.R. Holiday Caravans during the 1938 season are being made from all parts of the country, and reservations have already been made for over 500 weekly periods. In addition, all sites have been booked up for August Bank Holiday week. The L.M.S.R. will have over 200 caravans situated this summer at selected sites in England, Scotland, Wales, and Northern Ireland. From January 24 to 29 fully equipped caravan coaches were on exhibition at certain stations throughout the country, including Euston.

Littlehampton Station Improvements.—The Southern Railway announces that extensive improvements are to be made to Littlehampton station, Sussex. The existing platform is to be extended so as to accommodate the longest electric trains, and an additional platform, 530 ft. long, is being provided. The station buildings will be demolished and a new range of buildings with station forecourt for the use of motor-cars will be provided, facing Albert Road. The present locomotive shed and tank house will be demolished and a carriage cleaning shed provided, 800 ft. long and 55 ft. wide, to take 36 coaches. A footpath leading from Gloucester Road towards the River Arun is being stopped up where it crosses over the line, and a footbridge is being provided in lieu.

QUESTIONS IN PARLIAMENT

South-East London Tube Services

Mr. H. Day (Southwark, Central—Lab.) on February 9 asked the Minister of Transport whether he would give particulars of any negotiations that were in progress for the extension of and/or construction of further tube services in South-east London.

Dr. Leslie Burgin: I have made inquiries of the London Passenger Transport Board and understand that no such negotiations are in progress.

Late Trains Wanted for Empire Exhibition

Mr. Robert Gibson (Greenock—Lab.) on February 9 asked the Minister of Transport whether with a view to popularising among the inhabitants of Edinburgh and district the forthcoming Empire Exhibition in Glasgow, which would close each night not earlier than 10 p.m., he would represent to the two railway companies operating between Glasgow and Edinburgh the desirability of putting on trains to run from Glasgow to Edinburgh at 10.45 p.m. or later, there being no train at present leaving Glasgow for Edinburgh after 10 p.m., at which time the Empire Exhibition would still be open.

Dr. Leslie Burgin: I have communicated the hon. member's suggestion to the railway companies concerned, and will inform him of the result.

Cheap Tickets and Liability

Mr. Tom Cassells (Dumbartonshire—Lab.) on February 15 asked the Minister of Transport if he had anything further to report in relation to his promised negotiations with the railway companies concerning their liability in respect of their common law liability in respect of claims for damages on the issue of cheap excursion tickets.

Dr. Leslie Burgin (Minister of Transport): I hope to make a statement on this subject at an early date.

Mr. Cassells (Dumbartonshire—Lab.) on February 15 asked the Minister of Transport if he would make inquiries to ascertain whether members of the House were fully covered in respect of common law liability for loss, injury, and damage suffered whilst engaged in rail travel with railway vouchers issued to members.

Dr. Leslie Burgin: I am now discussing with the railway companies the question of the limitation of liability which they attach to cheap day, half day, and evening tickets, and workmen's tickets. Members are as fully

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covered as travellers purchasing their tickets in the ordinary way.

Railway Trucks

Mr. Ellis Smith (Stoke-on-Trent, Stoke—Lab.) on February 15 asked the Minister of Transport if he would take action with a view to securing, in future, the construction of railway coal trucks with a greater capacity, and an increase in trucks available.

Dr. Leslie Burgin: I have no powers to require the railway companies or private owners to provide a greater number of railway wagons. The average capacity of wagons used for the conveyance of coal has increased appreciably in recent years and as at present advised I see no necessity for action on my part.

Services to Norfolk

Mr. S. S. de Chair (Norfolk, S.W.—U.) on February 16 asked the Minister of Transport whether he was aware that the fastest train in the day from London to Swaffham, Norfolk, averaged only 32·22 m.p.h., compared with an average speed of 67 m.p.h. for the fastest train from London to Newcastle-on-Tyne; whether the existing line to Norfolk was capable of taking trains at greater speeds than at present; and, if so, whether he would make representations to the London & North Eastern Railway to speed up the services to Norfolk.

Dr. Leslie Burgin: I am in communication with the London & North Eastern Railway on the subject and will let my hon. friend know the result.

Parliamentary Notes

London Midland & Scottish Railway Bill

The London Midland & Scottish Railway Bill was read a second time on February 16. Mr. H. Parker (Romford—Lab.) and Mr. G. H. Oliver (Ilkeston—Lab.) who had tabled a motion for the rejection of the Bill did not move it.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 6th Week			Totals to Date		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,855½ mls.)						
Passenger-train traffic	388,000	379,000	+ 9,000	2,293,000	2,199,000	+ 94,000
Merchandise, &c.	494,000	475,000	+ 19,000	2,877,000	2,815,000	+ 62,000
Coal and coke	307,000	296,000	+ 11,000	1,862,000	1,715,000	+ 147,000
Goods-train traffic	801,000	771,000	+ 30,000	4,739,000	4,530,000	+ 209,000
Total receipts	1,189,000	1,150,000	+ 39,000	7,032,000	6,729,000	+ 303,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic	256,000	255,000	+ 1,000	1,537,000	1,489,000	+ 48,000
Merchandise, &c.	348,000	322,000	+ 26,000	1,985,000	1,910,000	+ 75,000
Coal and coke	282,000	274,000	+ 8,000	1,705,000	1,569,000	+ 136,000
Goods-train traffic	630,000	596,000	+ 34,000	3,690,000	3,479,000	+ 211,000
Total receipts	886,000	851,000	+ 35,000	5,227,000	4,968,000	+ 259,000
G.W.R. (3,737 mls.)						
Passenger-train traffic	160,000	155,000	+ 5,000	962,000	947,000	+ 15,000
Merchandise, &c.	196,000	189,000	+ 7,000	1,171,000	1,109,000	+ 62,000
Coal and coke	121,000	122,000	− 1,000	757,000	715,000	+ 42,000
Goods-train traffic	317,000	311,000	+ 6,000	1,928,000	1,824,000	+ 104,000
Total receipts	477,000	466,000	+ 11,000	2,890,000	2,771,000	+ 119,000
S.R. (2,147 mls.)						
Passenger-train traffic	256,000	252,000	+ 4,000	1,549,000	1,503,000	+ 46,000
Merchandise, &c.	61,000	60,000	+ 1,000	343,000	342,500	+ 500
Coal and coke	37,000	38,000	− 1,000	223,000	210,500	+ 12,500
Goods-train traffic	98,000	98,000	—	566,000	553,000	+ 13,000
Total receipts	354,000	350,000	+ 4,000	2,115,000	2,056,000	+ 59,000
Liverpool Overhead (6½ mls.)	1,308	1,148	+ 160	8,278	7,109	+ 1,169
Mersey (4½ mls.)	4,192	4,031	+ 161	26,443	25,345	+ 1,098
*London Passenger Transport Board	553,200	548,300	+ 4,900	18,528,800	18,439,400	+ 89,400
IRELAND						
Belfast & C.D. (80 mls.) pass.	1,600	1,663	− 63	10,191	9,833	+ 358
,, ,, goods	443	341	+ 102	2,494	2,582	− 88
,, ,, total	2,043	2,004	+ 39	12,685	12,415	+ 270
Great Northern (543 mls.) pass.	8,100	7,550	+ 550	47,800	44,000	+ 3,800
,, ,, goods	8,400	8,200	+ 200	48,400	50,550	− 2,150
,, ,, total	16,500	15,750	+ 750	96,200	94,550	+ 1,650
Great Southern (2,076 mls.) pass.	27,621	26,358	+ 1,263	166,487	157,733	+ 8,754
,, ,, goods	39,808	39,850	− 42	247,234	254,111	− 6,877
,, ,, total	67,429	66,208	+ 1,221	413,721	411,844	+ 1,877

* 33rd week (before pooling)

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices Feb. 16, 1938	Prices Rise/Fall
G.W.R.				
Cons. Ord.	67⅜	55¾	60	−3
5% Con. Prefce.	127	108	117½	—
5% Red. Pref. (1950)	113	109	110½	—
4% Deb.	113⅝	102½	109	−½
4½% Deb.	118	106	110½	—
4½% Deb.	124½	112	117½	—
5% Deb.	136½	122¾	129½	—
2½% Deb.	76	64	68½	—
5% Rt. Charge	133 7/16	118	126½	—
5% Cons. Guar.	133¾	116½	127½	+½
L.M.S.R.				
Ord.	36⅛	25⅜	21¾	−5¼
4% Prefce. (1923)	82½	65¾	62½	−5½
4% Prefce.	92½	77¾	80	−1½
5% Red. Pref. (1955)	107¾	102	103	—
4% Deb.	108	99¼	102½	−1
5% Red. Deb. (1952)	117½	111	113½	—
4% Guar.	104	95⅞	101½	−½
L.N.E.R.				
5% Pref. Ord.	12½	6¾	6½	−1
Def. Ord.	6¼	3⅝	3¼	−¼
4% First Prefce.	79½	63	63	−2½
4% Second Prefce.	31½	21	22	−2½
5% Red. Pref. (1955)	101¼	89¾	96½	—
4% First Guar.	103	91⅞	95	−½
4% Second Guar.	97⅝	85½	88	−1
3% Deb.	84⅛	74	76½	−1
4% Deb.	107¼	98½	101½	−1
5% Red. Deb. (1947)	113½	106½	110½	—
4½% Sinking Fund Red. Deb.	110 5/16	105½	107	—
Southern				
Pref. Ord.	98⅝	83½	82	−2
Def. Ord.	27⅞	16¾	20½	−½
5% Pref.	126 1/16	105 13/16	114½	—
5% Red. Pref. (1964)	118	110¼	114½	+1
5% Guar. Prefce.	133¾	116¾	127	+½
5% Red. Guar. Pref. (1957)	118½	111½	116	+1
4% Deb.	112	101¼	106½	−1
5% Deb.	135¾	123½	127½	—
4% Red. Deb. 1962–67	113	105	106½	—
Belfast & C.D.				
Ord.	5	4	4½	—
Forth Bridge				
4% Deb.	106	99½	100½	—
4% Guar.	105¾	99	100½	—
G. Northern (Ireland)				
Ord.	11	5	5¼	—
G. Southern (Ireland)				
Ord.	50	21½	23	—
Prefce.	61	34	33½	—
Guar.	94¾	69½	70¼	—
Deb.	95	82⅛	83	—
L.P.T.B.				
4½% "A"	123¾	110½	118½	—
5% "A"	135	121½	128½	—
4½% "T.F.A."	108¾	104	106	—
5% "B"	125	114½	121½	—
"C"	99¾	75	83	+2
Mersey				
Ord.	42¾	22	23*	—
4% Perp. Deb.	103	96¾	100	—
3% Perp. Deb.	77⅝	74½	74½	—
3% Perp. Prefce.	68¾	61¼	63½*	—

* ex. dividend

CONTRACTS AND TENDERS

Wagons for L.N.E.R.

The L.N.E.R. has placed orders for a total of 175 40-ton wagons for exceptional loads divided as follow: Metropolitan-Cammell Carriage & Wagon Co. Ltd., 100, and Birmingham Railway Carriage & Wagon Co. Ltd., 75 wagons.

The L.N.E.R. has also placed orders for a total of 800 single-bolster 12-ton wagons divided as follow: R. Y. Pickering & Co. Ltd., 200; Chas. Roberts & Co. Ltd., 400; and Hurst, Nelson & Co. Ltd., 200 wagons.

Central Tube Extension, Stratford Approaches Contract

John Cochrane & Sons Ltd. has received a contract, valued at £225,000, from the London Passenger Transport Board for the construction of tube approaches to the L.N.E.R. Stratford station. This is one of the key works on the extension of the Central tube line to Hainault and Ongar. It will enable tube trains to rise to the surface at one end of the Stratford station and dip down again at the other, thus providing platform interchange between the tube line and the L.N.E.R. Shenfield and Fenchurch Street lines. A new ticket hall will be built under the tracks at Stratford.

Alfred Herbert (India) Limited has received orders from the Chief Controller of Stores, Indian Stores Department, New Delhi, for one Massey 10-cwt. pneumatic hammer; one 30-in. Kitchen & Wade electrically driven boring, tapping, and studding machine; one Noble & Lund Fluifeed circular cold sawing machine; one Allen West Star Delta starter; one Noble & Lund automatic saw sharpening machine; and one Pels vertical plate straightening press.

Usines à Cuivre et à Zinc de Liége has received an order from the Egyptian State Railways Administration for copper plates (Ref. No. E.S.R. 6.269, total cost approx. £312, delivery f.o.b. Antwerp).

Steel, Peech & Tozer has received an order from the Buenos Ayres Western Railway Administration for 162 steel locomotive tyres.

Scottish Hotels Redecoration, L.N.E.R.

The L.N.E.R. is to spend £2,500 on internal and external painting of its Scottish hotels and the refreshment rooms at Queen Street station, Glasgow, during the next few weeks in readiness for the Empire Exhibition season. The contracts have been awarded as follow:

A. Ferguson & Co.: Palace Hotel and Station Hotel, Aberdeen.

R. Sinclair and W. & T. Scott: North British Station Hotel, Edinburgh.

T. Armour Limited: North British Hotel and Queen Street Station refreshment rooms, Glasgow.

J. Burns & Co.: North British Hotel (exterior), Glasgow.

Udeholm General Agencies Limited has received an order from the Madras & Southern Mahratta Railway for 2,300 steel boiler and 54 flue tubes to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Wagons for Kenya & Uganda Railways

The Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from the Crown Agents for the Colonies for 75 all-steel bogie high-sided wagons and 40 all-steel bogie low-sided wagons, equipped with Westinghouse brake, for service on the Kenya & Uganda Railways.

Indian Wagon Orders

The Government of India, Railway Department (Railway Board), has placed the following orders for a total of 286 I.R.S. wagons under the 1938-39 requirements:—

Braithwaite & Company: Six all-steel motor vans for B.N.R.; four all-steel motor vans and five MBVG wagons for E.B.R.

Burn & Company: One TO wagon, one BVG wagon, and one MBW wagon for E.B.R.; 40 TM wagons, 20 TO wagons, and 42 BVG wagons for E.I.R.; 100 BVG wagons for N.W.R. and 150 MC wagons and nine TP wagons for S.I.R.

Jessop & Company: Seven MCE type wagons for S.I.R.

Boilers for South Africa

The Soc. Anglo-Franco-Belge de Material de Chemins de Fer has received an order for six locomotive boilers with copper fireboxes required for Class "MJ" locomotives, South African Government Railways and Harbours Board.

Breakdown Crane Required

The Lourenço Marques Ports, Railways & Transport Administration is calling for tenders, to be presented in Lourenço Marques by April 14, for the supply and delivery of a 3 ft. 6 in. gauge steam-driven breakdown crane. Firms desirous of offering a crane of United Kingdom manufacture can obtain further details from the Department of Overseas Trade.

John Baker & Bessemer Limited has received an order from the Madras & Southern Mahratta Railway Administration for 80 locomotive tyres to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

John Baker & Bessemer Limited has also received an order from the Buenos Ayres Western Railway for 520 locomotive, carriage, and wagon tyres.

John Lysaght Limited has received an order from the South Indian Railway for 193 steel panel plates for carriages to be supplied to the inspection of Messrs. Robert White & Partners.

J. Jarvis & Sons Ltd. has received a contract from the London Passenger Transport Board for the conversion of Wood Green tram depot to trolleybus operation. The contract provides for building a new washing bay in the place of existing offices, which will be demolished.

Fried. Krupp A.G. has received an order from the Egyptian State Railways Administration for carriage and wagon tyres (Ref. No. E.S.R. 321.G3/14, total cost approx. £5,509, delivery f.o.b. Rotterdam or Antwerp).

Forges Usines & Fonderies Haine St. Pierre has received an order from the Egyptian State Railways Administration for cast steel axleboxes (Order No. 21.740, total cost £457, f.o.b. Antwerp).

Leyland Motors Limited has received an order from the New South Wales Railways Administration for six sets of railcar traction units.

Geo. H. Sheffield & Co. (Engineers) Ltd. has received an order from Hurst, Nelson & Co. Ltd. for two Sheffield-Twinberrow welded double-framed carriage bogies complete with wheels and axles and anti-friction roller bearings, required for the IRCA carriage underframe which, as recorded on this page in our issue of February 11, Hurst, Nelson & Co. Ltd. has on order from the Jodhpur Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton.

The Skefko Roller Bearing Co. Ltd. is to supply Skefko anti-friction roller bearings for the above-mentioned carriage underframe order.

Tenders are invited by the Bengal & North Western Railway, receivable by March 15 at 237, Gresham House, Old Broad Street, London, E.C.2, for the supply of 26,300 Tungsten filament lamps.

Tenders are invited by the Assam-Bengal Railway Administration, receivable by March 4 at 56, Victoria Street, S.W.1, for the supply of five boilers for "H" and "M" class 4-6-0 type locomotives and one boiler for "K" class 4-8-0 type locomotive.

Tenders are invited by the Egyptian State Railways Administration receivable in the Chief Inspecting Engineer's Office, 41, Tothill Street, London, S.W.1, for the supply of 27,700 kg. square mild-steel bars.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by February 22, for the supply of 30 motor lorry chassis.

Tenders are invited by the Egyptian State Railways Administration receivable at the Chief Inspecting Engineer's Office, 41, Tothill Street, London, S.W.1, for the supply of 12,200 kg. hexagonal steel bars of various sizes and 2,600 kg. rolled section steel bar for tyre retaining rings.

The South African Railways & Harbours Administration is calling for tenders (No. 1632) for the supply and delivery of approximately 430 tons of steelwork for bridges, together with quantities of rivets, bolts, and nuts. Tenders endorsed "Tender No. 1632 for Bridgework" should be addressed to the Secretary to the Tender Board, South African Railways & Harbours Headquarter Office, Johannesburg, to be received by April 11.

OFFICIAL NOTICES

The Institute of Transport Examinations, 1938

MARCH 1ST is the closing date for the deposit of forms of entry for the Graduateship and Associate Membership examinations to be held in London and at other centres on April 28th, 29th and 30th.

Particulars of the Institute and its examinations, together with previous examination question papers (price 1s. per set, post free), and copies of the Institute Examination Guide for prospective candidates (price 2s. 6d. post free), may be obtained from the undersigned.

A. WINTER GRAY,
Secretary.

15, Savoy Street,
London, W.C.2.

Bengal-Nagpur Railway Company Limited

THE Directors are prepared to receive Tenders for :—

A.—1,000 STEEL CARRIAGE AND WAGON TYRES. Item 1.

B.—1,000 STEEL CARRIAGE AND WAGON TYRES. Item 2

Specifications and Forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after 17th February, 1938.

A fee of 20s. will be charged for each copy of the Specification, which is *NOT* returnable.

Tenders must be submitted not later than Noon on Tuesday, 1st March, 1938.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

London & North Eastern Railway Company

NOTICE IS HEREBY GIVEN that the Fifteenth Ordinary General Meeting of the Proprietors of the London & North Eastern Railway Company will be held in the Wharncliffe Rooms, Hotel Great Central, Marylebone, London, N.W.1, on Friday, the 4th day of March, 1938, at 2.0 p.m., for the purpose of the general business of the Company; and for the purpose of approving the Agreement, dated 20th April, 1937, entered into by the Company for the sale to the Tyne Improvement Commissioners of the Company's Tyne Docks Undertaking.

NOTICE IS HEREBY FURTHER GIVEN that in accordance with the Standing Orders of Parliament a Special or Extraordinary General Meeting of the Proprietors of the Company will be held at the same place on the same day at 3.0 p.m., or as soon thereafter as the business of the Ordinary General Meeting is concluded, for the purpose of considering and, if thought fit, of approving the Bill which the Company have introduced into Parliament, intituled :—

"A Bill to empower the London & North Eastern Railway Company to widen certain of their railways; to construct other works in connection with their undertaking and to acquire lands; to confer further powers on the Company; and for other purposes."

Dated this 16th day of February, 1938.

By Order,
P. J. DOWSETT,
Assistant Secretary.

Marylebone Station,
London, N.W.1.

The Bengal & North Western Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of :—

26,300 TUNGSTEN FILAMENT LAMPS,

as per Specification to be seen at the Company's Offices.

Tenders addressed to the undersigned, and envelope marked "Tender for Electric Lamps," with the name of the firm tendering, to be lodged not later than Noon on the 15th day of March, 1938.

For each Specification a fee of 10s. will be charged, which cannot, under any circumstances, be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
J. WILLIAMSON,
Managing Director.

237, Gresham House,
Old Broad Street,
London, E.C.2.
14th February, 1938.

The West of India Portuguese Guaranteed Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of :—

STEELWORK FOR BRIDGES.

Specifications may be obtained at the Company's Offices. A charge of 10s., which will not be returned, will be made for each copy.

Copies of drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, Westminster, S.W.1.

Sealed Tenders, addressed to the Chairman and Directors of the West of India Portuguese Guaranteed Railway Company Limited, marked "Tender for Steelwork for Bridges," should be delivered to the undersigned not later than 3 p.m. on Tuesday, 15th March, 1938.

The Directors do not bind themselves to accept the lowest or any Tender.

LEONARD G. BOURCHIER,
Secretary.

4, Coleman Street,
London, E.C.2.

RAILWAY ENGINEER, aged about 25, sound general and technical education, railway and commercial training preferred, required by well-known engineering firm as Technical Salesman for interesting railway speciality with rapidly expanding world market. —Reply Box No. 92, c/o THE RAILWAY GAZETTE, 33, Tothill Street, London, S.W.1.

Universal Directory of Railway Officials and Railway Year Book

43rd Annual Edition, 1937-38

This unique publication gives the names of all the principal railway officers throughout the world, together with essential particulars of the systems with which they are connected. Much general and statistical information about railways is also concisely presented.

Price 20/- net.

THE DIRECTORY PUBLISHING CO. LTD.
33, Tothill Street, Westminster, S.W.1.

Exports of Railway Material from the United Kingdom in January

	Jan. 1938	Jan. 1937
	£	£
Locomotives, rail	131,904	129,984
Carriages and wagons	206,848	190,055
Rails, steel	97,959	144,813
Wheels, sleepers, fishplates and miscellaneous materials	207,358	84,039

Locomotive and rail exports included in the following :—

	Locomotives		Rails	
	Jan. 1938	Jan. 1937	Jan. 1938	Jan. 1937
	£	£	£	£
Argentina	9,049	9,522	7,148	3,184
Union of South Africa	—*	—*	27,590	82,308
British India	22,751	21,656	6,225	5,901

* Figures not available.

SURREY BORDER & CAMBERLEY RAILWAY.—The Surrey Border & Camberley Railway Limited was incorporated on January 22 with an authorised capital of £15,000 in £1 shares.

C.N.R. PURCHASES DURING 1937.—Purchases made by the Canadian National Railways during 1937 amounted to over £12 million from approximately 10,000 Canadian firms, and assisted materially in bringing various branches of Canadian industry back to normal conditions, states Mr. R. C. Vaughan, Vice-President in charge of purchases, stores, and steamships.

AIR-CONDITIONED SALOONS FOR MOZAMBIQUE. — Two new de-luxe saloons, built in Belgium for the Mozambique Railways, are to be put into service on the Lourenço Marques-Johannesburg run. Each coach is provided with air-conditioning equipment of British manufacture. Special attention has been paid to comfortable night travel, feather mattresses being provided for use on the convertible sleeping berths, and green silk curtains are available to enclose every berth.

STRATEGIC RAILWAY IN NILE DELTA.—It is reported that the British military authorities have rejected the Egyptian proposal to abandon the projected railway from Zagazig to Kafr ez-Zayat, on the Nile, intended to facilitate the movement and concentration of troops. The Egyptians proposed as an alternative a double line from Zagazig to Benha, which they estimated would save £E.270,000.

Forthcoming Meetings

Feb. 23 (*Wed.*).—**Great Western Railway Company** (Annual General), Paddington Station, London, W.2, at 11.30 a.m.

Feb. 24 (*Thurs.*).—**Southern Railway Company** (Annual General), Southern House, Cannon Street Station, E.C., at 11.30 a.m.

March 4 (*Fri.*).—**London & North Eastern Railway Company** (Annual General), Wharncliffe Rooms, Hotel Great Central, Marylebone Station, N.W.1, at 2 p.m.

March 10 (*Thurs.*).—**London Midland & Scottish Railway Company** (Annual General), Friends' Meeting House, Euston Road, N.W.1, at 11.30 a.m.

XUM

Railway Share Market

The downward movement in values has gathered momentum in all sections of the Stock Exchange, with the exception of British Government securities. The volume of business, which had already reached very small proportions, was further reduced owing to added uncertainty as to international political conditions, and the disposition was for prices to be marked down sharply on only a relatively moderate amount of selling.

Home railway stocks reflected the surrounding trend of markets, and the junior issues have moved to lower levels. Debentures and prior charge stocks were fairly well maintained in sympathy with Government securities. Sentiment was affected by the fact that comparison of the results for the past year with the statements for the first six months of 1937 shows that in the second half of last year net receipts made virtually little progress owing to the increased costs experienced. The tendency is to await the forthcoming meetings for information as to whether any further marked rise in expenditure will have to be faced this year. Fears as to the question of wage demands, and the fact that the past week's traffics were below market estimates, were other factors which influenced the position.

Southern deferred, although the steadiest feature, has not kept best prices, business having been recorded around 20½, while the preferred stock transferred below to 81 at one time. Great Western ordinary failed to benefit from the 4 per cent. dividend. The company retained a relatively satisfactory percentage of its gross receipts. L.M.S.R. ordinary declined to around 22, while the 4 per cent. 1923 preference was lowered to 62½ and the 4 per cent. preference to 80. Nevertheless the disposition is to expect that at the meeting it may be indicated that costs are not likely to show an appreciable further rise this year. L.N.E.R. second preference reacted to around 22, awaiting the dividend announcement, while the first preference, which appears to offer an attractive yield, declined to 62½. The £35,000 increase in the railway's receipts for the past week created a favourable impression, but in existing market conditions this was without influence on prices. London Transport "C" was a bright feature, there having been a rise to 83½ under the influence of the view expressed recently by the chairman of Thomas Tilling, that the stock is likely to receive a dividend of 5½ per cent. this year.

Movements in foreign railway stocks were again to lower levels, surrounding market conditions having proved the dominating factor. Argentine railway preference stocks, however, showed a rather steadier appearance subsequently, as did the debentures, although prices were lower on balance. In other directions Canadian Pacific preference was better on the doubling of the dividend to 2 per cent., but the common stock transferred at lower prices.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937-38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1937	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: Feb. 16 1938	Yield % (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	13.2.38	17,240	+ 1,810	7	103,740	96,580	+ 7,160	Ord. Stk.	29	10¼	12½	Nil
	Argentine North Eastern	753	12.2.38	7,748	+ 1,067	33	309,326	293,299	+ 16,027	,,	19¼	6	4½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	93½	60	80	5
	Bolivar	174	Jan., 1938	3,600	— 1,800	5	3,600	5,400	— 1,800	6 p.c. Deb. Bonds.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Ord. Stk.	17	9	8½	5 7
	Buenos Ayres & Pacific	2,806	12.2.38	110,112	— 10,669	33	2,735,053	2,789,496	— 54,443	Ord. Stk.	17⅛	5½	5	Nil
	Buenos Ayres Central	190	29.1.38	$88,500	— $76,600	31	$3,820,900	$4,429,200	— $608,300	Mt. Deb.	41½	18	12½	Nil
	Buenos Ayres Gt. Southern	5,084	12.2.38	224,504	— 6,948	33	4,685,793	4,522,599	+ 163,194	Ord. Stk.	33¾	13½	12½	Nil
	Buenos Ayres Western	1,930	12.2.38	48,821	— 12,345	33	1,504,839	1,549,519	— 44,680	,,	31¾	11¼	9	Nil
	Central Argentine	3,700	12.2.38	115,068	— 63,437	33	4,139,617	4,869,860	— 730,243	,,	34¼	10¾	9	Nil
	Do.	—	—	—	—	—	—	—	—	Did.	20½	4½	5	Nil
	Cent. Uruguay of M. Video	980	5.2.38	21,596	— 2,190	32	552,601	551,085	+ 1,516	Ord. Stk.	67$_{32}$	2	2½	Nil
	Cordoba Central	1,218	—	—	—	—	—	—	—	Ord. Inc.	6¼	1½	1½	Nil
	Costa Rica	188	Dec., 1937	31,844	+ 12,491	23	155,206	110,934	+ 44,272	Stk.	38	27	26½	79 6
	Dorada	70	Jan., 1938	17,700	+ 2,400	5	17,700	15,300	+ 2,400	1 Mt. Db.	107	106	106½	5 5
	Entre Rios	810	12.2.38	16,911	+ 5,044	33	477,651	435,060	+ 42,591	Ord. Stk.	19⅞	6	5	Nil
	Great Western of Brazil	1,092	12.2.38	9,300	+ 1,200	7	60,400	60,900	— 500	Ord. Sh.	¾	⅛	¼	Nil
	International of Cl. Amer.	794	Nov., 1937	$50,126	+ $82,245	48	85,379,250	$4,650,651	+ $728,599	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	2/	1/-	1½	Nil
	La Guaira & Caracas	22¾	Jan., 1938	4,610	— 1,660	5	4,610	6,270	— 1,660	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	12.2.38	19,901	+ 2,423	7	120,671	134,406	— 13,735	Ord. Stk.	9¼	3	3	Nil
	Mexican	483	7.2.38	$308,500	— $9,100	6	$1,598,370	$1,623,200	— $24,800	,,	1½	¼	½	Nil
	Midland of Uruguay	319	Jan., 1938	12,586	+ 1,824	31	65,059	60,985	+ 4,074	,,	1⅞	½	½	Nil
	Nitrate	384	31.1.38	9,653	+ 4,359	5	16,429	12,075	+ 4,354	Ord. Sh.	3$_{16}$	2	2$_{16}$	Nil
	Paraguay Central	274	5.2.38	$2,718,000	— $89,000	32	$101,083,000	$84,444,000	+ $16,639,000	Pr. Li. Stk.	84	79¼	76½	7$_{16}$
	Peruvian Corporation	1,059	Jan., 1938	83,749	+ 3,948	31	587,785	570,583	+ 17,199	Pref.	14⅝	4½	5	Nil
	Salvador	100	5.2.38	¢43,750	— ¢4,750	32	¢581,125	¢598,758	— ¢17,633	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153½	6.2.38	34,000	+ 589	6	162,521	161,561	+ 959	Ord. Stk.	9⅛	56	46	10⅞
	Taltal	160	Jan., 1938	6,295	+ 2,705	31	28,830	24,490	+ 4,340	Ord. Sh.	1$_{16}$	1$_{16}$	¾	13$_{16}$
	United of Havana	1,353	12.2.38	52,277	+ 1,125	33	629,072	616,465	+ 12,607	Ord. Stk.	5⅝	3$_{32}$	3	Nil
	Uruguay Northern	73	Jan., 1938	1,072	+ 50	31	6,372	7,616	— 1,244	Deb. Stk.	10	2	3½	Nil
Canada	Canadian National	23,803	7.2.38	651,776	— 23,044	6	3,316,103	3,483,491	— 167,388	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	—	4 p.c.				
	Grand Trunk	—	—	—	—	—	—	—	—	Perp. Dbs.	77	62½	71½	5 9
	Canadian Pacific	17,186	7.2.38	463,600	— 17,800	6	2,526,600	2,520,200	+ 6,400	4 p.c. Gar.	101⅞	94½	100	4
										Ord. Stk.	18	7¼	7	Nil
India†	Assam Bengal	1,329	20.1.38	40,703	— 4,201	43	1,108,965	1,079,751	+ 38,214	Ord. Stk.	86	73½	81	3 11 6
	Barsi Light	202	20.1.38	4,965	+ 1,823	43	110,370	93,180	+ 17,190	Ord. Sh.	66½	46	57	8 5 4
	Bengal & North Western	2,107	31.1.38	87,747	— 2,876	18	927,161	953,602	— 26,441	Ord. Stk.	317	301	305	5 7 8
	Bengal Dooars & Extension	161	31.1.38	4,515	+ 987	45	124,430	111,495	+ 12,935	,,	100	84	87½	6 7 8
	Bengal-Nagpur	3,268	20.1.38	178,875	— 470	43	5,562,115	4,847,939	+ 714,176	,,	101	89	91½	4 8 8
	Bombay, Baroda & Cl. India	3,072	10.2.38	263,175	— 39,075	47	7,603,200	7,545,150	+ 58,050	,,	113	110½	111½	5 5 8
	Madras & Southern Mahratta	2,937	20.1.38	148,200	— 15,463	43	4,411,728	4,448,852	— 37,124	,,	119	105	107½	7 5 16
	Rohilkund & Kumaon	571	31.1.38	18,902	— 2,078	18	171,193	181,115	— 9,922	,,	314	302	309	5 15 16
	South Indian	2,531½	20.1.38	115,253	+ 2,208	43	3,374,374	3,234,615	+ 139,759	,,	103½	98½	100½	4 5 4
Various	Beira-Umtali	204	Dec., 1937	90,397	+ 21,605	13	276,730	206,068	+ 70,662	—	—	—	—	—
	Egyptian Delta	620	20.1.38	7,382	— 155	43	216,317	206,078	+ 10,239	Prf. Sh.	3/-	¾	1¼	Nil
	Kenya & Uganda	1,625	Dec., 1937	195,953	— 9,301	52	2,710,000	2,527,158	+ 182,842	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48⅛	43½	47½	8 11 16
	Midland of W. Australia	277	Dec., 1937	15,204	+ 401	26	84,334	82,054	+ 2,280	Inc. Deb.	98	93½	93½	4 4
	Nigerian	1,900	1.1.38	69,400	— 3,230	40	2,104,835	1,734,265	+ 370,570	—	—	—	—	—
	Rhodesia	2,451	Dec., 1937	421,643	+ 72,205	13	1,317,239	1,038,328	+ 278,911	—	—	—	—	—
	South Africa	13,263	22.1.38	632,167	+ 11,332	43	27,481,346	26,000,591	+ 1,480,755	—	—	—	—	—
	Victoria	4,774	Aug., 1937	696,068	— 43,173	9	—	—	—	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value.

Diesel Railway Traction

Direct Drive

ONCE again direct drive is being brought to the fore, and again by the performance of the Deutz 4-4-4 locomotive, which, since it was last described in the pages of this Supplement (January 26, 1934) has been subjected to considerable modification and improvement, and has recently been operating experimentally on passenger and goods trains in the Rhine district. All diesel locomotives with direct drive built up to the present time have incorporated two-stroke engines because of their superiority at starting, owing to the number of impulses being twice as many as in the four-stroke engine, and as a result of years of intensive experiment it has been found possible in the present Deutz double-acting two-stroke locomotive to begin firing during the first revolution. This is in itself probably the greatest single advance yet made in the production of a direct drive locomotive suitable for doing normal work. Direct drive always has been the conscious or unconscious aim of railway engineers connected with diesel traction, and the increasing use made of mechanical transmission is simply a movement in this direction, and there is little doubt that if a successful direct drive locomotive could be built and offered, a large demand for such machines would soon be created. If applied to passenger services this might retard the still further development of diesel trains and railcars, and thus bring to a halt the progressive improvement of railway operation which is now in sight, but the direct drive solution would be quite suitable for the operation of freight traffic. There is no reason why this simplest of all forms of transmission should not be adapted to railcars and set trains. Indeed, it is remarkable that more work has not been done in this direction, for the technical problems are simpler. The earlier Bugatti petrol-engined cars in France had direct drive in which was embodied a fluid coupling, but the later models have a two-speed Cotal gearbox. The only other direct drive railcar of which we are aware is the small experimental Leroux car built in France shortly after the war.

Single or Double Engine Installations?

TECHNICAL points of extremely great interest present themselves by a comparison of the latest type of express diesel train set to work on the German State Railway with the preceding trains. There are in service already 14 twin-car and four triple-car trains, all of the articulated type with a power-transmission plant mounted on the bogies of each end car, and another 14 triple-car trains of similar type, but non-articulated, are in course of construction. But the train just put into traffic is a four-car non-articulated rake, with one car given over entirely to power and transmission equipment and luggage and postal space. Moreover, it has only one main engine, and this, with its attached main generator, is located in the body of the car. This single-power unit thus leads to some simplification in regard to the number of engine parts, and by supplementing it with a small high-speed auxiliary engine it has been found possible to provide an installation of 1,550 b.h.p. compared with the maximum of 1,200 b.h.p. in the three-car trains. But the b.h.p. per ton has not been increased; in fact, it is rather less, and the seating accommodation is no more, except that 29 additional seats are fitted in a small dining saloon. Elaborate arrangements have been made to get the train to a convenient station or siding should the main engine fail, and in this respect, at least, the present arrangement must be somewhat inferior to the double-engine layout, which, if one engine should fail, can be worked home at a reasonably high speed. Any withdrawal of the 1,400 b.h.p. single engine necessitates removal of a section of the roof and sides of the power car. The fact that the engine is mounted on the underframe need not be taken as a movement away from bogie mounting in general, particularly as more than a dozen trains with bogie-mounted engines are being built, for when powers of 1,400 b.h.p. in a single unit are under consideration it is obvious that room for the prime mover and its generator can hardly be found on a bogie. Precautions have also been taken to enable the auxiliaries to be supplied, should the auxiliary engine-generator set fail, by the incorporation of an emergency generator overhung from the main dynamo. Some simplification in the controls of a single-engine installation may be expected, especially if multiple-unit operation is contemplated, but a disadvantage is that if, as in the present train, half the traction motors are located on the vehicle farthest from the power car, it is necessary to carry the main traction circuit cables from car to car. It is true that the use of this single-power installation has enabled the total horsepower per train to be increased compared with the maximum so far obtained with a double-engined bogie-mounted train, but it is not improbable that the increment of power from supercharging could be increased from the 45 per cent. at present used in the double-engined trains in Germany to a value still greater, or else the capacity of a train could be increased simply by coupling two rakes in multiple-unit. The secret of all-round success and efficiency in a single-engined train of the power now under consideration appears to be an engine so reliable that no complicated preventive or emergency equipment is necessary, or, alternatively, simply to risk a breakdown.

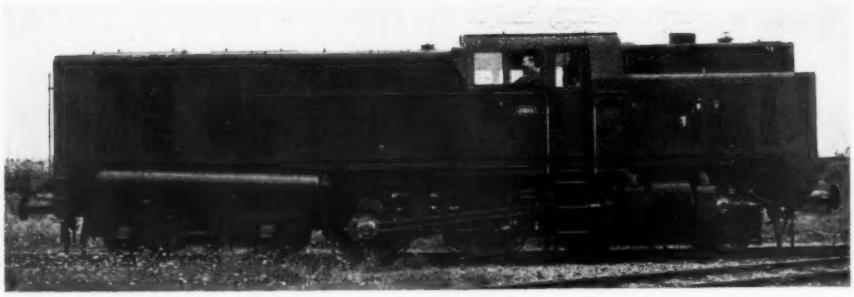
Berlin Motor Show

AS usual, there are exhibits of diesel traction interest at this year's Berlin Motor Show, which is open from February 18 to March 6. The Humboldt-Deutzmotoren A.G. is showing a six-cylinder 130 b.h.p. light-weight engine running at 2,000 r.p.m., which is one of a range varying from 70 to 200 b.h.p. with speeds of 1,600 and 2,000 r.p.m., and built by the Deutz associate company, Magirus, of Ulm. There is also an eight-cylinder horizontal Deutz engine which is of particular interest in that it is not of the *vis-à-vis* type, but has only one bank of cylinders. It has an output of 200 b.h.p. at 1,600 r.p.m., and its overall dimensions are 8 ft. 3 in. long, 4 ft. 2 in. wide, and 2 ft. 0½ in. high. Other Deutz exhibits are a two-seater motorcar with a 100 b.h.p. oil engine, and 28 and 50 b.h.p. units of the same type, and on the Reichsbahn stand is one of the Deutz 12-cylinder 275 b.h.p. horizontal oil engines (of the Reichsbahn standard type), which gained a *Grand Prix* at the Paris exhibition last year. The same stand also contains one of the Deutsche Werke Kiel 275 b.h.p. horizontal engines. The Deutsche Getriebe G.m.b.H. has on view at the Vomag stand a five-speed Mylius gearbox with automatic speed control, and suitable for engine outputs up to 300 b.h.p.

XUM

DIRECT-DRIVE MAIN-LINE DIESEL LOCOMOTIVE

Experiments with the latest version of the Deutz double-acting two-stroke design



Deutz 1,500 *i.h.p. diesel locomotive as running experimentally in Germany*

AT a meeting of the Engineers' German Circle at the Institution of Mechanical Engineers on January 17, Dr. Finsterwalder, of the Humboldt-Deutzmotoren A.G., gave a lecture on the recent developments of the direct-drive diesel locomotive evolved by that firm, which was the subject of an article in our issue of January 26, 1934. Since that date the locomotive has been improved and tested in service on the German State Railway. In July, 1937, runs were made on the Cologne-Troisdorf line, followed later by runs on the Cologne—Neuss—Klene line, when speeds up to 70 m.p.h. were attained. The latter series of tests was made with fast goods trains and on a stopping passenger train service normally operated by steam locomotives of the 4-6-0 " P8 " class.

The diesel locomotive was handicapped in two respects. In the first place both the scavenge blowers, which were mounted on brackets and subject to some unforeseen stress and vibration, failed and were made good by makeshift repairs, which, however, were insufficient to prevent the scavenge pressure and the efficiency of the locomotive from being affected. Secondly, the short distances between stations tried the locomotive in the most difficult circumstances. The compressed air installation proved itself fully equal to the demands of such a service, but the fuel consumption of the auxiliary engine became noticeable under these conditions. Nevertheless, the locomotive distinguished itself by its ability to keep better time than is normally required, owing to its high accelerative power. It has not yet been possible to make systematic dynamometer car tests of the locomotive. Random tests show a fuel consumption per gross *tonne*-km of about 4-5 grammes. The specific consumption with a train load of 200 tons was 400 grammes per d.b.h.p.hr.

Why Direct Drive?

Dr. Finsterwalder devoted the introduction to his lecture to a consideration of the operating factors which render direct drive a worth-while aim in diesel locomotive design. Unless electric transmission is of very ample, and therefore costly and weighty, proportions, the capacity of the engine cannot be fully and continuously utilised, due to heat losses and limitation of temperature in the transmission. Hydraulic transmission suffers a similar disadvantage due to relatively high hydraulic losses at the higher speeds. In Fig. 1, where tractive effort curves for the three methods of drive are shown for comparison, it is assumed that the hydraulic transmission involves a hydraulic torque converter and two coupling speeds.

The diesel engine is primarily a constant-torque engine, whose power therefore increases with its speed. In railway service it is necessary that the torque, or tractive effort, should be highest at low speeds and decrease as the speed rises, so that some method of augmenting the mean effective pressure of the engine at low speeds is necessary with direct drive. This is accomplished in the Humboldt-Deutz engine by introducing high-pressure air during combustion. An auxiliary engine drives a compressor at constant delivery, so that with decreasing speed

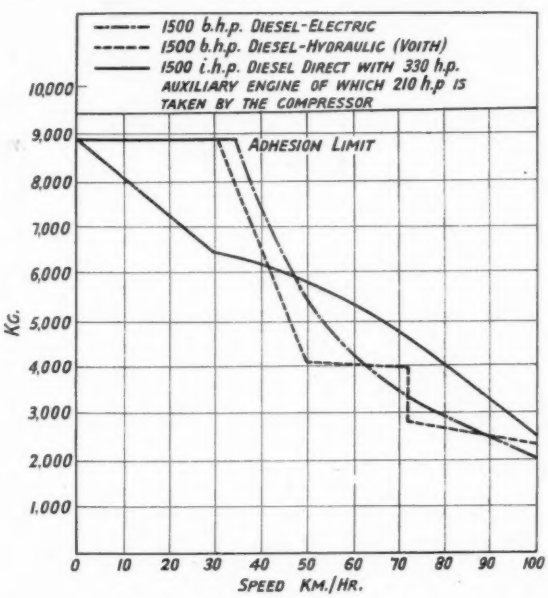


Fig. 1—*Comparative tractive effort curves with three types of transmission*

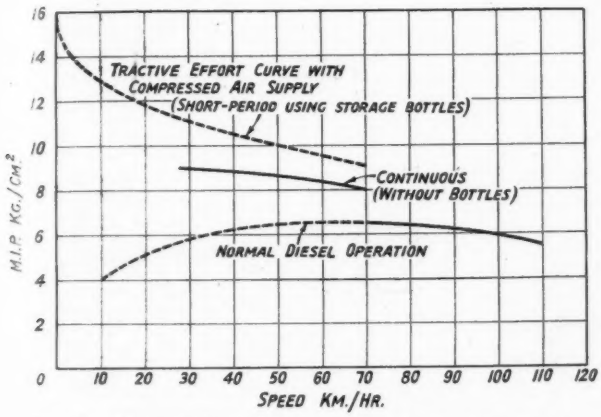

TRACTIVE EFFORT CURVE WITH COMPRESSED AIR SUPPLY (SHORT-PERIOD USING STORAGE BOTTLES)
CONTINUOUS (WITHOUT BOTTLES)
NORMAL DIESEL OPERATION
M.I.P. KG./CM.²
SPEED KM./HR.

Fig. 2—Mean indicated pressures under various conditions of working

of the main engine each stroke gets a larger proportion of compressed air, the m.e.p. rising accordingly. As a basis of design a mean indicated pressure of 5·5-6 atm. (78 to 85 lb. per sq. in.) was adopted for pure diesel operation, and increased to 8·5-11 atm. (120-155 lb. per sq. in.) as the maximum continuous indicated pressure with supplementary compressed air operation.

The size of the auxiliary plant is determined by the speed at which it is intended to reach the higher mean pressure. The compressor was designed to take power amounting to 14 per cent. of the output of the main engine, and increases the power of the latter to about 1·7 times its rating. This would lead to a very high tractive effort at low speeds but for the facts (1) that the m.e.p. of the two-stroke engine is in practice not altogether independent of the speed, and (2) that the efficiency of the compressed air supply is reduced. In order to secure great tractive effort at starting, therefore, the compressed air supply is supplemented from bottles carried on the locomotive. The size of the bottles is determined on the one hand by the ability of the locomotive to start a train which can be hauled continuously and also accelerated sufficiently on a given gradient, and on the other hand by the requirement that full pressure can be pumped up in the bottles by the compressor within five minutes. Fig. 2 shows the tractive effort curves under the various running conditions.

In order that firing may begin during the first revolution of the driving wheels, *which is actually achieved in this locomotive*, a double-acting two-stroke cycle engine having at least six cylinder heads and 100 deg. admission is necessary. The engine always works under compression, which facilitates firing. Electrically-heated glow coils of " microtherm," which store a considerable amount of heat and cannot be blown cold by the compressed air, are used. Even this, however, is insufficient, for when the fuel is injected at starting, atomisation under the normal injection pressure of 300 atm. (4,250 lb. per sq. in.) is too coarse and fuel delivery is inadequate. Favourable results with reliable ignition were obtained with a twist nozzle under an injection pressure of 80 atm. (1,140 lb.),

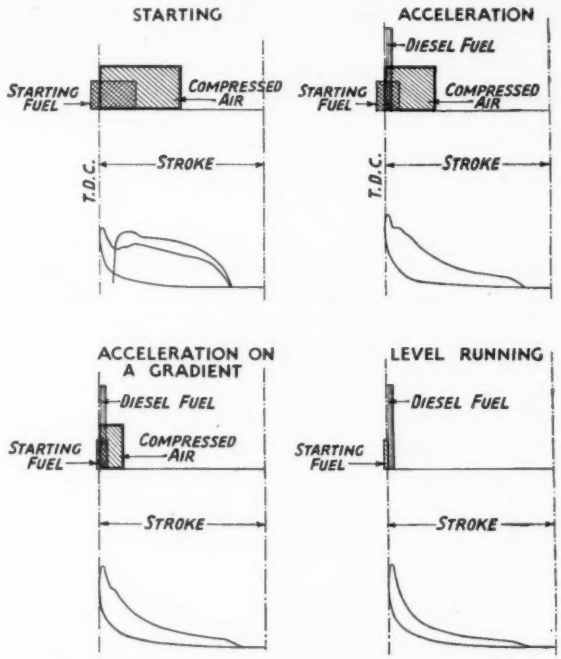


Fig. 3—Indicator diagrams under various operating conditions, Deutz direct-drive locomotive

which, with very little penetrating force, caused the finest dissemination of the fuel; this is supplemented by a second high-pressure starting fuel pump with normal high-pressure nozzles.

Fig. 3 shows the combined effect of the three sources of supply on the indicated combustion diagram under conditions of starting, acceleration, acceleration on a gradient, and normal running on the level, and Fig. 4 shows the fuel supply arrangements. As too early introduction of the compressed air causes an excessively high ignition pressure, the air is admitted for a short portion of the stroke after the dead centre. To keep the consumption of compressed air within practicable limits the m.e.p. in normal diesel operation was raised as high as possible over the greatest possible range of speed by making the pistons a tighter fit with the help of specially treated rings and efficient lubrication, and by ensuring effective scavenging and an ample supply of scavenge air at low speeds. Experience with this locomotive has shown that it is essential for direct-drive diesel traction

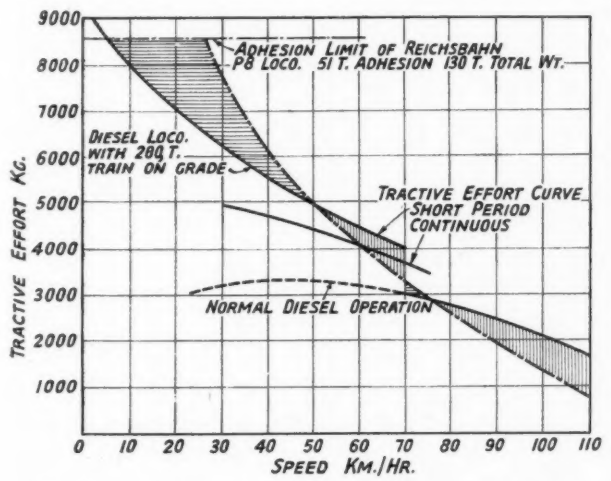

ADHESION LIMIT OF REICHSBAHN P8 LOCO. 51 T. ADHESION 130 T. TOTAL WT.
DIESEL LOCO. WITH 200 T. TRAIN ON GRADE
TRACTIVE EFFORT CURVE SHORT PERIOD CONTINUOUS
NORMAL DIESEL OPERATION
TRACTIVE EFFORT KG.
SPEED KM./HR.

Fig. 2A—Tractive effort under various conditions of working of Deutz direct-drive locomotive compared with steam engine

to provide an auxiliary engine, not only for compressed air charging, but for the scavenge air supply, as, if driven by the main engine alone, the scavenging effect would be too imperfect at low speeds. Scavenging air is normally supplied by two Roots blowers provided with a changeover valve permitting a change of direction of running. But at speeds below 80 km.p.h. (50 m.p.h.) the scavenging pressure is augmented by an electrically-driven auxiliary blower.

The measures described above enabled the m.i.p. to be raised to 6·5-7 atm. (92-100 lb.), but it was found at first that severe shocks were then caused at injection. Adjustment of the two fuel pumps eventually cured this trouble, the starting fuel pump being used for the advanced ignition of the fuel supplied by the service fuel pump. In consequence of the long pipes an ignition point timing device operated by a servo-governor and meshing with the service pump was required. The time of ignition of the starting pump is constant, and is so adjusted that in the lower range of speed ignition can be relied upon to commence prior to the entry of the compressed air and the action of the service pump. In the higher range of speed the starting pump injects only enough fuel to keep the nozzles clear. By these means it has been found possible to make the locomotive run almost as smoothly as a steam locomotive, and the sound of the exhaust is very reminiscent of that of a steam locomotive.

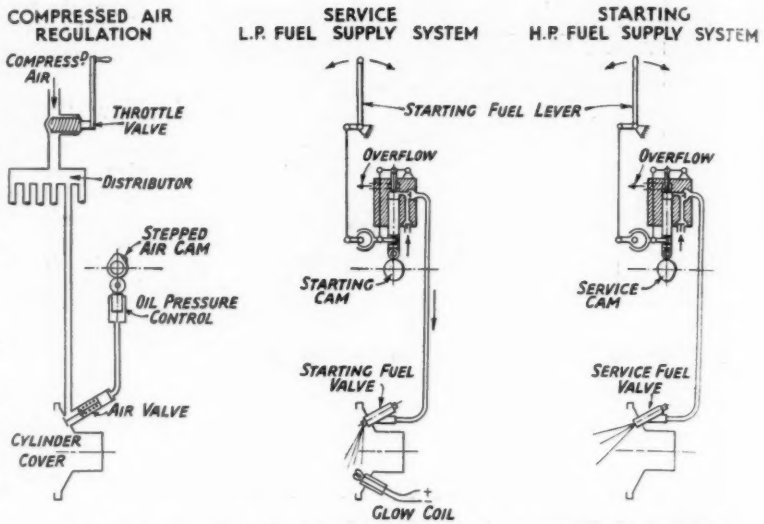


Fig. 4—Fuel supply arrangements for the three systems of working

The motion arrangement of a three-cylinder steam locomotive was adopted, the front driving axle being driven by the middle cylinder and the rear driving axle by the two outside cylinders. The cylinders are 380 mm. bore by 600 mm. stroke, provided with a port scavenging device similar to the Schmerle type. Water cooling under pressure is employed. The air compressor is a three-stage two-cylinder high-pressure machine of 150 h.p. maximum output, driven by a three-cylinder four-stroke engine of 225 b.h.p. A supercharger is employed for the engine and the compressor. A 50 kW. generator driven by the

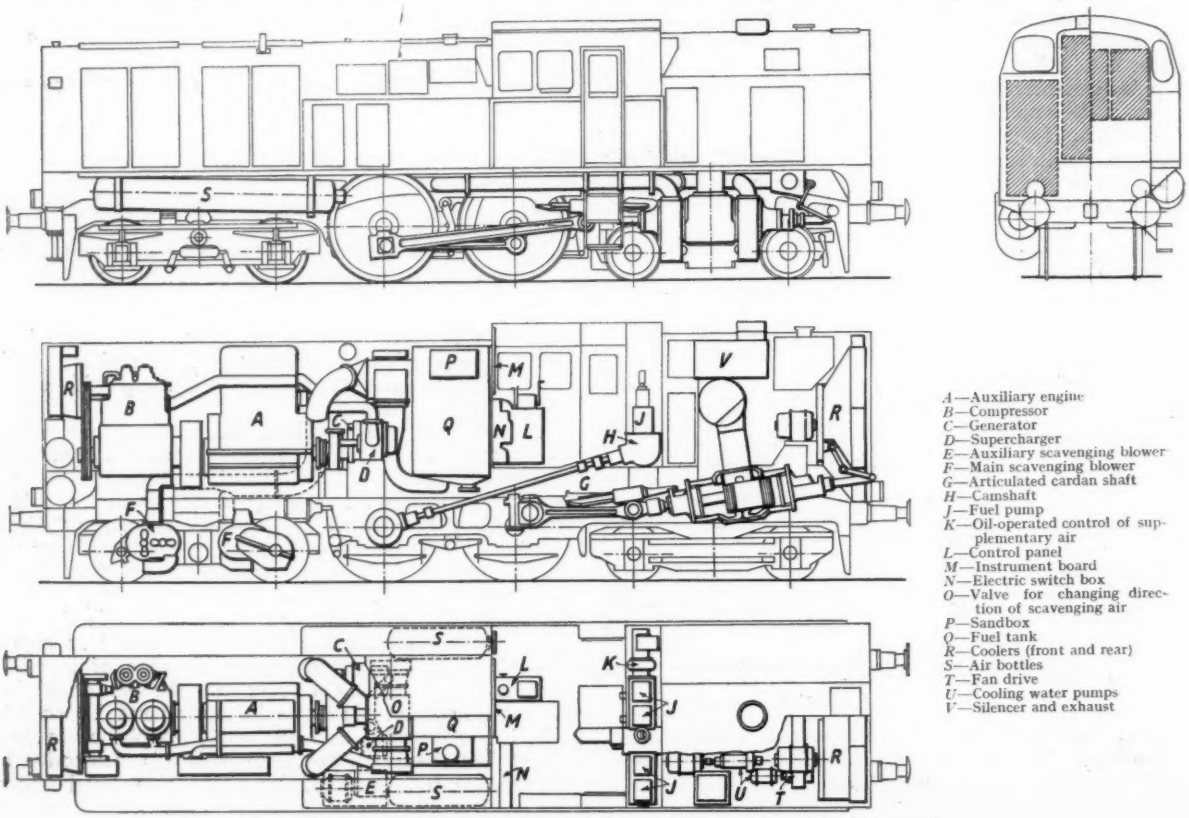


Fig. 5—Layout of equipment on 4-4-4 type Deutz direct-drive locomotive

same engine serves to drive the auxiliary scavenge blower. The compressor is put out of action by lifting the suction valves of all the stages, but the auxiliary engine must be kept running on account of the electrically-driven cooling plant. Six air bottles of 2·2 cu. m. (78 cu. ft.) capacity are provided. Other particulars of the locomotive are: Diameter of driving wheels, 1,750 mm. (69 in.); total length over buffers 14,550 mm. (44 ft. 6 in.); adhesion weight 36 *tonnes*; total weight in running order, 87 *tonnes*; fuel storage, 2,500 kg. (5,500 lb.). Fig. 5 shows the general arrangement of the locomotive and the layout of the equipment. Curves of 395 ft. radius can be traversed at slow speed.

To start the locomotive, the following is the procedure: The driver makes sure that the bottles are charged to a pressure of 48 atm. (685 lb. per sq. in.), sets the valve motion to full cut-off, the starting pump to full and the service pump to mean cut-off, and admits air to the cylinders by means of the throttle lever. The locomotive starts with a pressure of from 10 to 30 atm. (140 to 425 lb.). During the first revolution firing begins. The admission of air and the cut-off of the starting pump are now decreased, whilst the air pressure and the service pump cut-off are increased. At a speed of 20 km.p.h. (12½ m.p.h.) the service pump fuel supply preponderates. At 30 km.p.h. (18½ m.p.h.) the most effective use of the compressor air takes place, which thereafter is reduced until at 70 or 80 km.p.h. (43 to 50 m.p.h.) the compressor is set to no load and diesel operation proper begins. The driver adjusts the quantities of fuel supplied so that the exhaust is only just visible.

The driving gear and frame of the locomotive are somewhat heavier than for an ordinary steam locomotive, but careful examination has shown little wear on the crankpins and axleboxes, whilst the lining of the connecting rod bearings remains in rather better condition than in stationary diesel engines. The three-cylinder arrangement gives good balancing and constant torque and the extra weight of the motion helps to smooth out the driving impulses.

Diesel Engine Users Association

THE Twenty-fifth Anniversary Dinner of the above Association took place at the Connaught Rooms on February 9, and was attended by 120 members and their guests. The President, Mr. T. Hornbuckle, the Chief Technical Assistant to the Chief Mechanical Engineer, L.M.S.R., was unfortunately prevented by illness from attending, but his place in the chair was ably filled by Mr. F. A. Greene, the Association's Honorary Treasurer.

In proposing the toast of the Association, Major-General S. Capel Peck, President of the Institution of Automobile Engineers, referred to his contact with several associations, which he classified as "learned societies," in that they were more concerned with the technical, academic, and research sides of engineering: the Diesel Engine Users Association, however, was concerned with the use of machines—a more solid consideration than mere learning. Mr. F. A. Greene, replying to the toast, expressed his regret at the absence of Mr. Hornbuckle, who, he said, had done so much to develop the use of diesel engines on railways, and he remembered with particular gratitude the facilities which Mr. Hornbuckle had afforded their Association for inspecting the L.M.S.R. diesel locomotives at Crewe. The toast of "Our Guests" was proposed by Mr. A. K. Bruce, and responded to by Mr. C. E. Fairburn, Deputy Chief Mechanical Engineer and Electrical Engineer, L.M.S.R.

A Light-Metal Railcar

TWO 150 b.h.p. diesel-mechanical four-wheeled railcars of special construction have been built by M.A.N. for the German State Railway and placed in service on the Rothenburg-ob-der-Tauben to Dombühl and Rothenburg-Steinach lines. The oil engines are of M.A.N. build. The wheels, axles, axleboxes, springs, part of the buffer mountings, and the subframe carrying the engine are of steel, but the remainder of the cars, including the chassis, body, and roof framing and panels, rivets, flooring, running boards, doors, window frames, seat frames, luggage racks and fittings generally are of Hydronalium, an aluminium-magnesium alloy supplied by the I.G. Chemikal m.b.H. It has a specific gravity of 2·6 and a magnesium content of 12 per cent.; it is easily worked and has a high degree of resistance to chemical actions. The inside of the car is covered in a sound-proof material and the ceiling is of three-ply wood. The outside surface is unpainted and shows simply the true colour of the Hydronalium. The tare weight of the car is 12·3 tons compared with the 16·4 tons of the standard Reichsbahn steel railcar of 150 b.h.p.; the saving in weight thus amounts to 25 per cent., and the weight per seat has been reduced from 750 lb. to 591 lb. The b.h.p. per ton of tare is 12·2 and this permits of a high rate of acceleration even when a trailer is being hauled.

EDUCATIONAL RAILCAR.—The P.L.M. section of the French National Railways has converted an old Renault 100 b.h.p. petrol-engined railcar into an instructional vehicle to travel to various centres for assisting in the training of the staff and apprentices. A small cinema has been incorporated to show technical films.

ITALIAN DIESEL SERVICES.—On February 12 the entire steam passenger services on the Udine—Cervignano and Palmanova—S. Giorgio di Nogaro lines of the Italian State Railways were replaced by diesel railcars having second and third class accommodation. On the first line nine return trips are being made daily in the place of five steam trips, and the journey time has been reduced to 23-30 min. from 39-69 min. On the S. Giorgio line there are six diesel trips compared with five journeys in steam days, but the diesels start from Udine and take 30 min., whereas the steam trains began at Palmanova. Over the Palmanova—S. Giorgio section the railcars are scheduled to take 12 min. compared with the 27-30 min. of the preceding steam trains. Experience with diesel cars on these lines in the mountain districts has shown adequate heating of the passenger saloons in winter to be something of a problem.

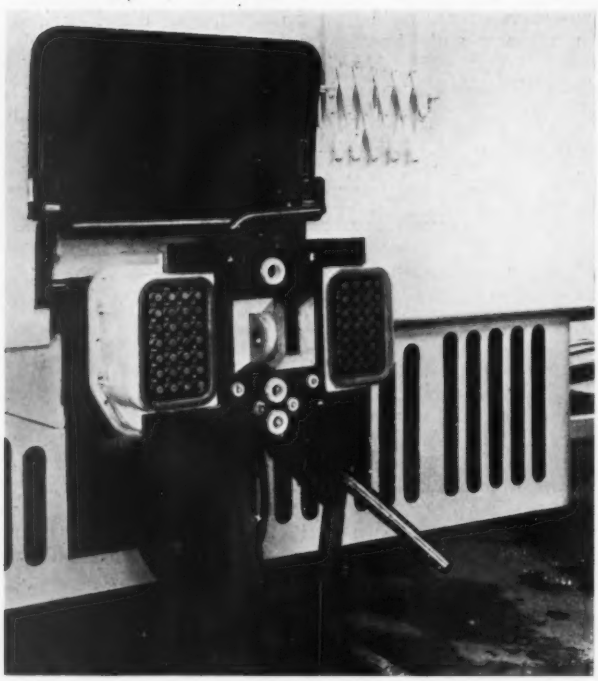
XUM

FAST TWIN-CAR TRAINS IN ROUMANIA

Accelerated schedules on two important lines made practicable by diesel traction

Right: Twin-car train engaged in fast interurban single-class traffic

Below: Inter-car automatic centre coupler carrying the electro-pneumatic engine and gearbox controls and the air brake connections

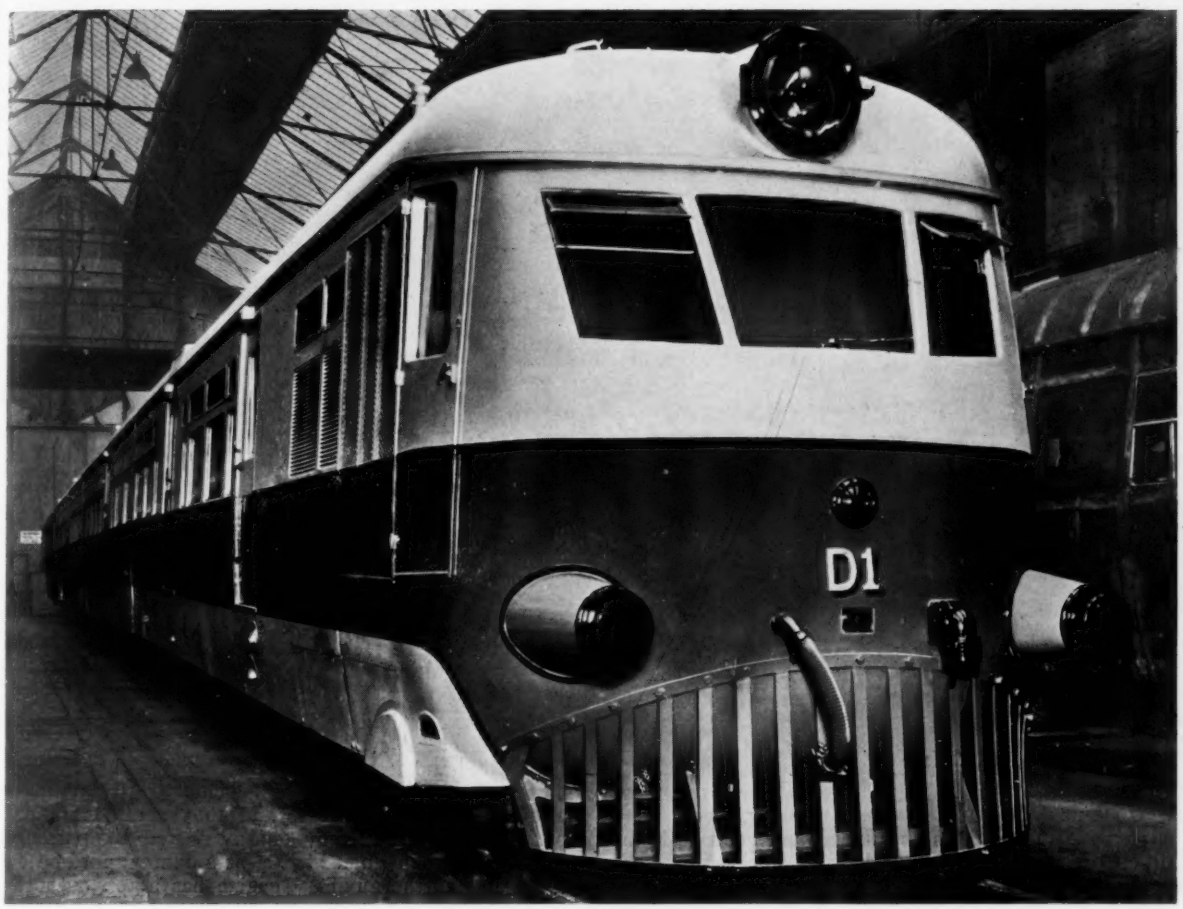


THE latest of the 200-odd diesel vehicles of the Roumanian State Railways are three trains each composed of two close-coupled non-articulated cars built by Ganz & Co., of Budapest, in conjunction with the Malaxa works in Bucharest, and are equipped with two 300 b.h.p. engines and five-speed mechanical transmission sets, one to each car. These rakes are engaged in fast service between Bucharest and Constantza and Bucharest and Brassov. Each car seats 68 passengers in one long saloon. There is a vestibule connection between the cars, which are identical as to layout and equipment. As in the usual Ganz cars, the complete body framework and the panels are built up by electric welding. Insulation against external heat and cold is provided by multiple layers of Alfol arranged between the outer steel panel plates and the interior wood lining. The floor has a covering of cork on which is laid a rubber carpet, and the seats have upholstered Laticel rubber cushions.

All the windows in the passenger saloon are of the drop type and have adjustable aluminium louvres. Air-conditioning equipment of the Ganz type (see issue of this Supplement for September 6, 1935) is fitted, and thereby the ventilating air is kept cool and dry in hot weather. The heating of the cars in cold weather is effected by the use of the engine cooling water. The mechanical equipment of the air-conditioning plant is mounted on a sub-frame suspended from the car underframe and insulated from it by rubber blocks.

The two cars are connected by an automatic centre coupler which contains the electro-pneumatic junctions of the remote-control gear and those of the air brake, as shown in the illustration on this page. Emergency couplers and buffers are fitted at the outer ends. The electro-pneumatic remote-control gear is simply for the operation of either or both engines and gearboxes from either driving compartment, and is not of the multiple-unit type. The engines are of the six-cylinder pattern with a bore and stroke of 170 mm. by 240 mm., and have a peak output of 310 b.h.p. at 1,450 r.p.m. The weight is about 4,800 lb. The crankcase is a light alloy casting and is surmounted by three cast-iron cylinder blocks, each comprising a pair of cylinders. Both the engine and gearbox are mounted on the bogie, and there is a cardan shaft drive to the auxiliaries mounted below the underframe. The overall length of a twin-car rake is 153 ft. 6 in., and the bogies of each car are at a pitch of 53 ft. 10 in. The 36¼-in. wheels are spread over a base of 12 ft. 11½ in. in the power bogies and over 11 ft. 2 in. in the inner carrying bogies. A top service speed of 68 m.p.h. is permitted. In the ceiling of each driving compartment is located a 77-gal. fuel tank.

DIESEL TRAINS FOR CEYLON



THREE four-car articulated diesel-electric trains have been built for the broad-gauge lines of the Ceylon Government Railways by the English Electric Co. Ltd., and they are to be utilised on the Colombo-Matara suburban section. They were built to the requirements of Mr. W. A. Smythe, the Chief Mechanical Engineer, and to the inspection of the Crown Agents for the Colonies.

Each rake is powered by two 200 b.h.p. English Electric oil engines fitted with C.A.V.-Bosch fuel injection pumps, governor, and fuel transfer pumps, and mounted one at each end of the train. The engine is fitted also with Auto-Klean oil filters, Burgess intake silencers and filters, and the circulating water is cooled in Spiral Tube radiators, as illustrated on p. 153 of our January 21 issue. Direct-coupled to each engine is a d.c. generator with a one-hour rating of 120 kW., a maximum voltage of 600, and a maximum current of 600 amp. Four 112 h.p. nose-suspended traction motors are used, and they are mounted two on each end bogie. There is a 24-cell Exide Ironclad battery of 161 amp.hr. capacity which furnishes current for engine starting, and for the control and lighting circuits, and for running the auxiliaries when the main engine is at rest. Multiple-unit control is embodied.

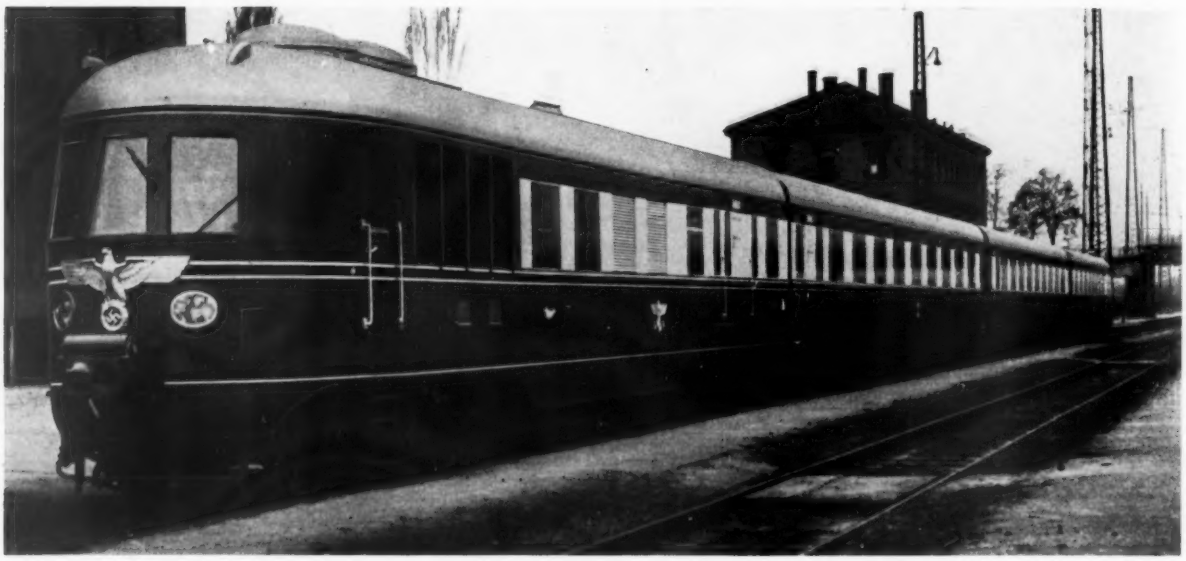
The body framings of the cars are of welded steel construction, and an illustration of them was given on p. 138 of the January 21 issue of this Supplement. The panel plates and sections are of copper-bearing steel, and the panels are attached to the framing by spot welding. All metal subject to corrosion is coated with a composition which is semi-plastic when dry and which thus does not crack or peel off. First, second, and third class accommodation is provided to a total of 17 first, 42 second, and 241 third seats, but there is no through vestibuled communication between the coaches. The first class seats are of Dunlopillo on Alpax frames, and those in the other classes have tubular steel frames with cushions having spring fillings and Hairlok squabs covered in Rexine. Monarch ventilators, Stone's lighting fittings and ventilating fans, and Beclawat windows are fitted throughout, and Roberts' asbestos insulation has been applied to the inside faces of the panel plates. The cars have a double roof with a 2¼-in. air space between, and this, together with the oscillating fans in the passenger saloons, aids in keeping the interior of the train cool. Lavatory accommodation is provided in all classes.

Welded steel swing-bolster bogies are used throughout, and all the axles are supported in SKF roller bearing axleboxes. The 34-in. solid disc-type wheels are braked on the Westinghouse system through clasp rigging and two blocks per wheel. The trains measure 206½ ft. in length and 9 ft. 10 in. in maximum width. They tare 94 tons, and with a full complement of passengers and stores weigh about 116 tons. The top speed is 55 m.p.h.

XUM

NEW DESIGN OF DIESEL-ELECTRIC TRAIN IN GERMANY

Non-articulated welded steel set with single power plant



1,550 b.h.p. diesel-electric train for express service, German State Railway

AS an experiment, the German State Railway in its latest express diesel train has departed from the standard twin-car and triple-car designs with a power plant mounted on the bogies at each end, and has had built by M.A.N. a four-car rake powered by a single engine mounted on the underframe, and with the addition of a small engine to look after the supply of power to the auxiliaries. As may be seen from the accompanying diagram, one of the end cars is shorter than the other three, and it houses the main and auxiliary engine equipment; the remainder of its length is taken up by baggage and postal spaces, and the engine vibrations, noise and smell are thereby kept away from the passenger saloons. The main engine has a maximum output of 1,400 b.h.p. and as the auxiliary engine has a top output of 150 b.h.p., the power installation of the train totals 1,550 b.h.p. This contrasts with the 1,200 b.h.p. of the Reichsbahn three-car sets and the 820 b.h.p. of the twin-car rakes, both of which sets are of articulated form. The fully laden weight of the new non-articulated four-car train is 207 *tonnes*, equivalent to about 190 *tonnes* tare. The power output is thus 7·5 b.h.p. per *tonne* of gross weight, compared with 8·6 b.h.p. for the three-car trains and 8·1 b.h.p. for the twin-car set. It is not proposed to operate the four-car set at the regular 100 m.p.h. speeds of the twin-car and triple-car sets. Directly coupled to the main engine is a d.c. generator, and current from this is fed to four nose-suspended traction motors, two on each inner bogie of the end cars.

Interior of dining saloon

The passenger portion of the train is of the compartment type with a side corridor, and is second class only. There are 126 seats plus 29 in a small dining saloon in the end car remote from the power plant. Between this dining room and the driving compartment are a pantry and a kitchen. Heating of the passenger compartments is through hot water heating of the incoming air stream, and a Pintsch oil-burning heater is installed to raise the temperature of the water. The cars have normal vestibule connections with outer bellows of the full car width, and Scharfenberg automatic couplers are fitted to permit instantaneous coupling of the mechanical, pneumatic, and electric circuits, apart from the main electric power circuits to the two traction motors not on the power car.

All-steel welded construction has been used in the

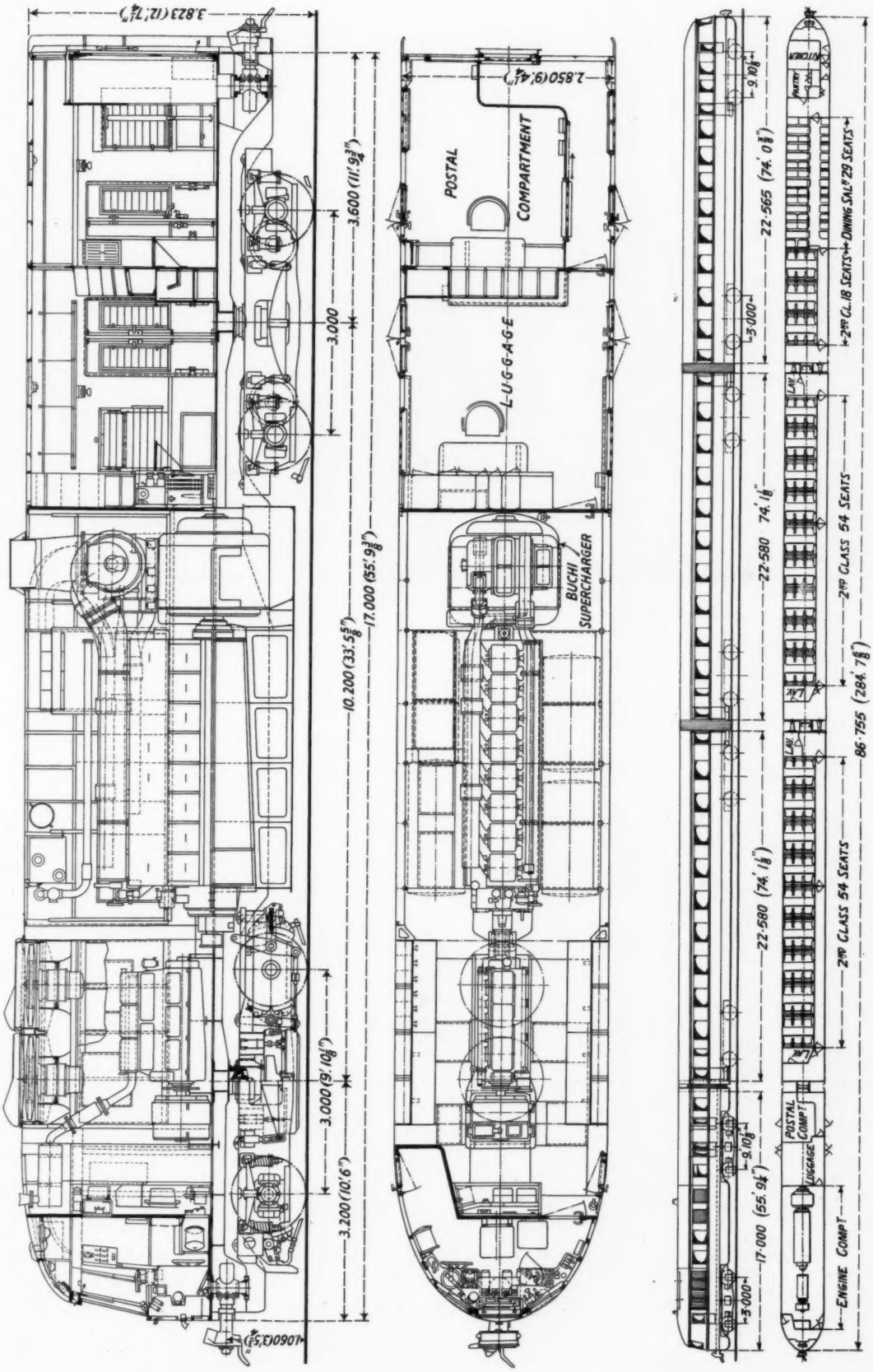


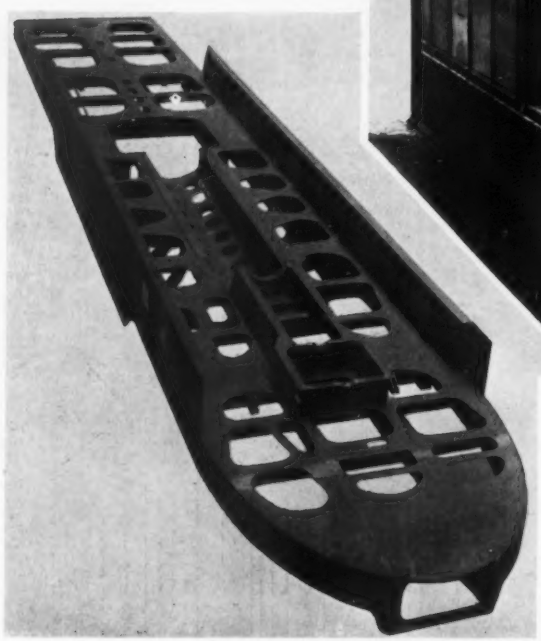
Diagram of Reichsbahn four-car 1,550 b.h.p. diesel-electric train and general arrangement of the power car

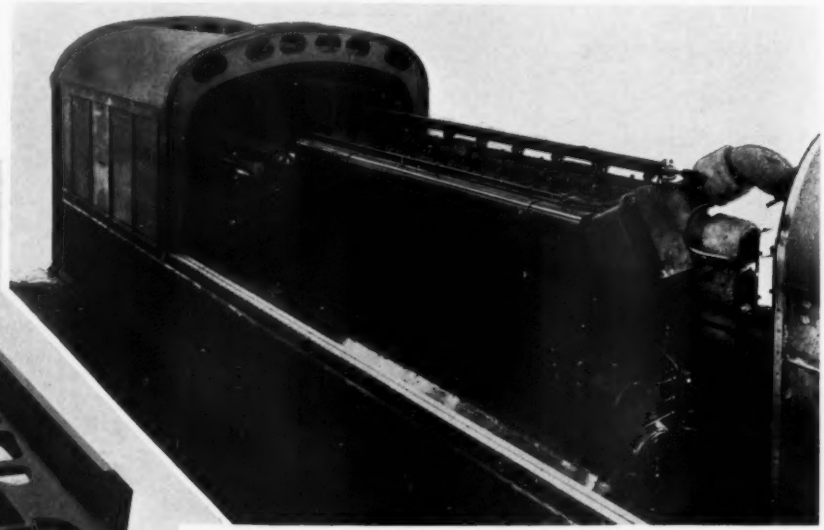
fabrication of the car framing, more particularly for the power car, which has a massive welded bedplate type of framing to carry the main and auxiliary engines and their equipment, and incorporated in this structure or carried by it are the fuel and lubricating oil tanks, the cable ducts, and the air reservoirs. The fuel tanks are three in number, of aluminium plate, and have an aggregate capacity of 1,650 litres (363 gal.). The whole centre portion of the roof of the power car is removable, so that the engine can be lifted out, but forward of this there is another integral welded-steel framework extending approximately from waist rail level over the roof to the in each driving compartment, but it actuates only the blocks on the bogie beneath it. Air sanding gear is fitted to the motored wheels, but it is applied also under electric control to the carrying wheels in order to improve the braking performance on the occasion of an emergency stop.

Engine Equipment

Traction power is provided by a four-stroke vertical M.A.N. engine developing 1,400 b.h.p. at 700 r.p.m. in eight cylinders 300 mm. bore by 380 mm. stroke and supercharged on the Büchi exhaust gas system. The

Below : Welded steel underframe and engine bedplate of power car of the Reichsbahn four-car train. It weighs about 7½ tons





Above : Power car of four-car train of German State Railway with centre portion of roof and sides removed. The main engine is of the M.A.N. eight cylinder type developing 1,400 b.h.p. at 700 r.p.m., and at the right-hand end can be seen the ducts to and from the Büchi supercharger. At the left-hand end is a 150 b.h.p. M.A.N. high speed engine used for supplying power to the auxiliaries

other side, and embodying the side radiator frames, fan casings, and the semi-streamlined end framing. The bogies have frames of welded steel construction, and bolsters riding on inverted laminated springs outside the frames. The roller bearing axleboxes have independent overhung laminated springs with helical auxiliaries.

Three braking systems, viz., Hildebrand-Knorr compressed air, electro-magnetic, and hand are fitted. The air system is a combination of the automatic system and the non-automatic electrically-controlled brake, and when braking at the top speed can exert a force equal to 200 per cent. of the tare weight of the train, the braking force being applied to the wheel treads through clasp rigging and two very large blocks per wheel. At speeds of 37 to 40 m.p.h. and below the retarding force is regulated by a centrifugal governor to a maximum of 75 per cent. of the tare weight. Each bogie has two magnet shoes fed with a 17·3 amp. 110-volt current, giving a retarding force between magnet and rail of 11·2 *tonnes*; the magnets are lifted and held in the off position—about 5¼ in. above rail level—by two compressed air cylinders, and the magnetic brake can be applied only in conjunction with the air brake. There is a hand screw brake

supercharger capacity is 105 cu. m. (3,700 cu. ft.) a minute at a pressure of 0·3 atm. (4¼ lb. per sq. in.) when running at 11,500 r.p.m. The weight of the supercharging equipment is 870 kg. (1,920 lb.) and of the engine complete with supercharger, 10,900 kg., or 24,000 lb. At 1,400 b.h.p. the piston speed is 1,750 ft. per min., the brake m.e.p. 120 lb. per sq. in., and the unit weight 17 lb. per b.h.p. The compression ratio is 13 to 1. The auxiliary engine is an M.A.N. high-speed four-stroke engine developing 150 b.h.p. at 1,500 r.p.m. in six vertical cylinders with a bore and stroke of 150 mm. and 180 mm., respectively; it has a compression ratio of 17·8 to 1 and is fitted with a Bosch fuel pump injecting into precombustion chambers.

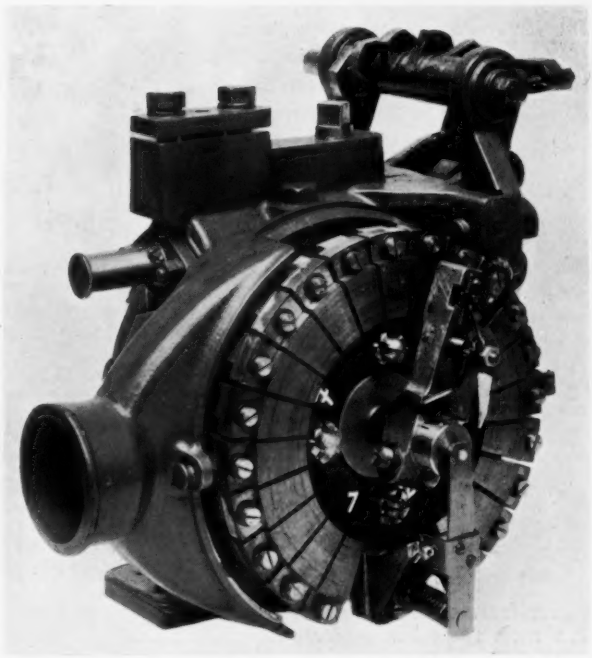
Radiators mounted on each side of the power car are used, and air is pulled in through the spaces between the gilled tube elements and ejected through the roof by two fans driven by electric motors with a maximum output of 25 h.p. at 1,240 r.p.m. when coupled in parallel. The driver can connect these two motors in either series or parallel. The fans, together with their casings and top protecting grilles, are mounted in a welded steel framework as shown in one of the attached illustrations. Ele-

ments for both water and oil are provided in the radiators: the former are required to cope with 385,000 calories an hour from the main engine and 90,000 calories from the auxiliary engine; the oil elements must deal with 65,000 and 13,000 calories from the main and auxiliary diesel engines, respectively. The total cooling surface is 488 sq. m. (5,250 sq. ft.) for water and 163 sq. m. (1,750 sq. ft.) for oil. The cooling water circulation is equivalent to about 75 cu. m. (16,500 gal.) an hour, of which about 10½ per cent. is due to the auxiliary engine; the oil circulation approximates to 25½ cu. m. (5,600 gal.) an hour, of which about 21 per cent. is for the small engine. The air circulation through the radiators amounts to a maximum of 28 cu. m. (1,000 cu. ft.) a second. Both main and auxiliary engines are started electrically, but in an emergency the main engine can be started by compressed air, stored in a 125-litre (4½ cu. ft.) reservoir at a pressure of 75 atm. (1,160 lb. per sq. in.).

The complete electrical equipment was supplied by the Mannheim works of Brown Boveri, and incorporates a control on the Brown Boveri servo-field regulator system suitable for multiple-unit operation. The control is arranged to keep the main engine to one of three speeds and one of six loads in addition to idling at 400 r.p.m., as indicated in the accompanying table.

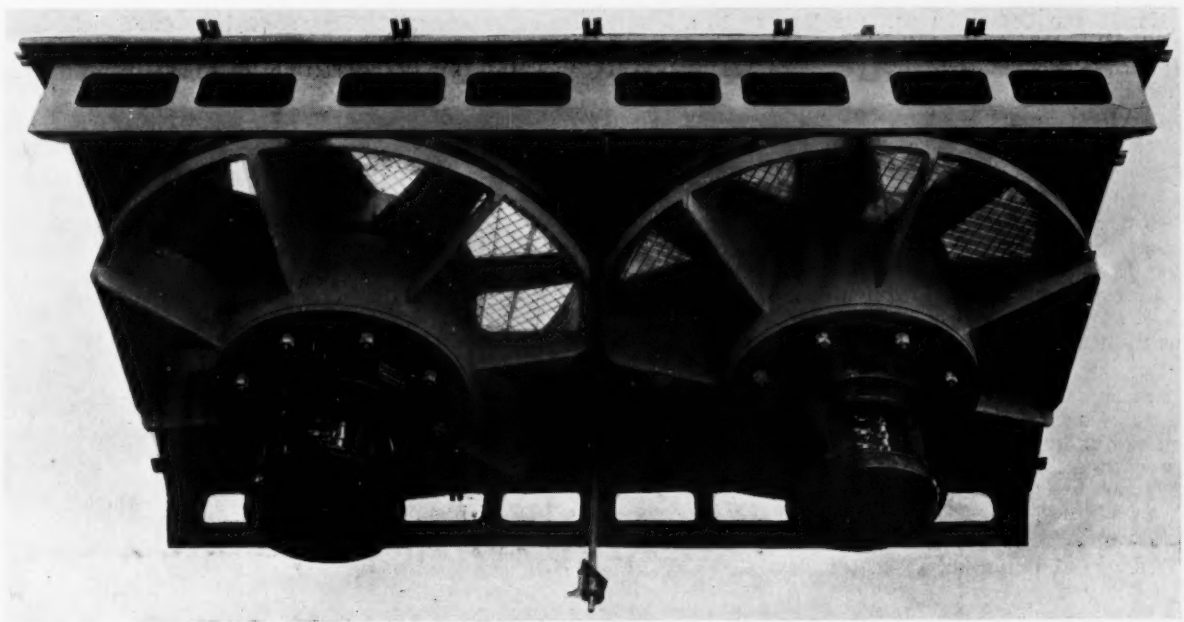
Notch	R.p.m.	Torque, per cent.	B.h.p. per cent.
I	400	50	28
II	550	50	40
III	550	85	67
IV	700	85	85
V	700	100	100
Overload	700	111	111

The main generator has a rated one-hour current of 1,320 amp., a continuous rating current of 972 amp., and a maximum voltage of 1,150. It incorporates self-exciting, separately-excited and anti-compound windings, and carries an overhung but built-in auxiliary generator with a capacity of 65 kW. at 130 volts when turning at



Brown Boveri servo-field regulator incorporated in electric transmission of Reichsbahn train

700 r.p.m. This auxiliary machine is located partly inside the commutator of the main generator, and is used only as an emergency machine if the generator driven by the 150 b.h.p. oil engine should fail. The complete group weighs about 6,700 kg. (14,800 lb.). The auxiliary diesel engine is direct-coupled to a 130-volt generator with a capacity of 71·5 kW. when the engine is running at 1,200 r.p.m.; its weight is 950 kg. (2,100 lb.). With the auxiliary engine running at its top speed of 1,500 r.p.m. the voltage is raised to 180. This set supplies



Motor-driven ventilator fans for German State Railway's 1,550 b.h.p. oil-electric train

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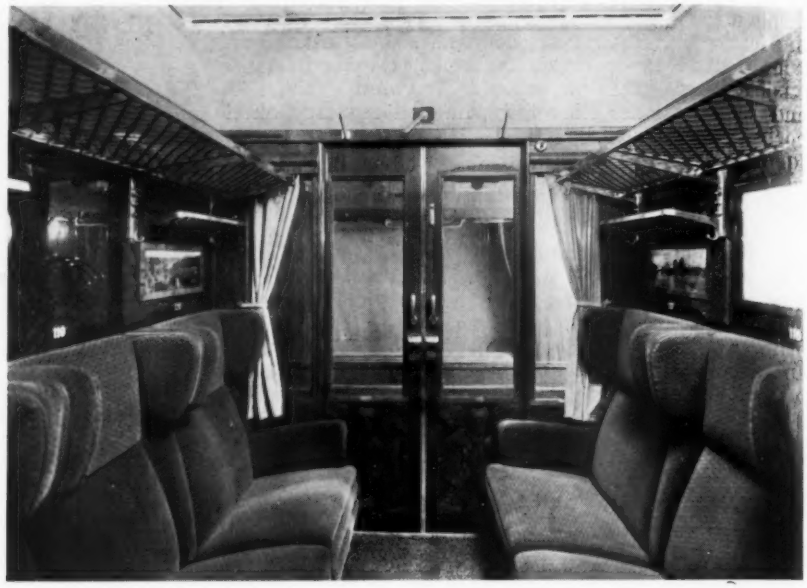

Interior of second-class compartment of new four-car diesel-electric train built by M.A.N. for the German State Railway for use on express interurban services

power for the air compressor, battery charging, lighting, fan motors, and also for the excitation of the main generator.

A type of spring drive evolved by Brown Boveri is used to transmit the torque of the traction motors to the driving axles. The gear ratio is 1 to 3·61; the pinion on the end of the armature shaft is of the normal solid type, but the gear wheel contains eight helical spring cushioning groups. The motor itself is secured to the bogie frame structure. Each motor has a one-hour rating of 223 kW., a continuous rating of 208 kW. (at a speed of 2,370 r.p.m.), a maximum voltage of 1,150, and a weight with gears and gearcase of 1,860 kg. (4,100 lb.). The track wheels have a diameter of one metre (39·3 in.).

The transmission and control have been arranged in a manner such that if the main diesel engine should fail the auxiliary engine and its generator can be brought into the traction circuit and supply sufficient power for the train to be worked at a low speed to the nearest convenient station. The control in these circumstances has three notches; on the first the auxiliary engine is operated at 1,200 r.p.m. and the self-excitation of the generator is in circuit with a resistance, the power output being small. In the second notch the auxiliary engine runs at 1,500 r.p.m., and its generator, with reduced excitation, develops about 60 kW. In the third notch the speed is again 1,500 r.p.m., but the magnitude of the excitation is greater than that in the first notch and the top output of the auxiliary generator is 100 kW., corresponding to an output of the engine of 150 b.h.p.

HIGH-SPEED DIESEL PAPER.—On January 18 a lecture on the British high-speed diesel engine was given at the Holborn Restaurant by Mr. L. W. J. Hancock, of F. Perkins Limited, of Peterborough.

AUSTRO-DAIMLER CARS.—The double-bogie petrol-engined Austro-Daimler railcars of the Austrian Federal Railways are being rebuilt with six-cylinder 100 b.h.p. Oberhänsli high-speed diesel engines, two to each car.

PARIS SUBURBAN DIESELS.—The Nord section of the French National Railways is operating suburban trains from Paris (Gare du Nord) to Beauvais and from Paris to Argenteuil, Sannois, and Ermont with 300 b.h.p. Renault diesel cars. The seven units operating on this service at the moment cover a daily mileage of 770.

GERMAN SUPER-SPEED DIESELS.—Fourteen triple-car streamlined trains, each powered by two Maybach 600 b.h.p. 12-cylinder engines equipped with Büchi superchargers are now under construction for the German State Railway. In contradistinction to the existing four triple-car trains, the new rakes will be non-articulated ; the cars thus will be of greater length and more accommodation will be available.

MICHELIN WITHDRAWALS.—The four original pneumatic-tyred Michelin railcars of the Ch. de fer du Nord, set to work between December, 1932, and March, 1933, have been withdrawn from service, owing mainly to their low seating capacity, 24. They are to be replaced by 36-seater Michelins. They have covered 270,000, 254,000, 222,000 and 215,000 miles, respectively, and have been operating from the depots at Creil and Valenciennes.

MULTIPLE-UNIT TRIALS.—Three of the 99 single-engined 100 b.h.p. Drewry diesel-mechanical railcars for the Buenos Ayres Great Southern Railway were recently coupled in multiple-unit and subjected to an intensive test, being driven up and down a short test track for 12 hr. on end, making about 120 round trips (240 reversals) and covering over 100 miles. The top speed attained was about 20 m.p.h. One of the cars was also run singly up and down this track for 24 hr. on end.

DUTCH LOCAL DIESELS.—The Maas Light Railway, in Holland, which has had small diesel-electric locomotives running for some years (see issue of this Supplement for March 22, 1935) has recently rebuilt two more of its vans as diesel-electric locomotives, and the entire passenger and goods traffic is now worked by five diesel units. The first three locomotives have Stork-Ganz engines of 85 b.h.p., and the last two have engines of 240 b.h.p., and are used for operating goods traffic. All locomotives have a driving cab at each end, and trains of two or three passenger coaches are a normal formation. Both air and hand brakes are fitted and the normal maximum speed of all the locomotives is 60 km.p.h. (37 m.p.h.).

Dr. Dorpmüller on Diesels

IN an article in the December, 1937, issue of the Journal of the German Chamber of Commerce, Dr. Julius Dorpmüller, the Reichs-Minister of Transport and General Manager of the Reichsbahn says that apart from steam and electric locomotives, the internal combustion engine has in recent years been increasingly used for express train traffic. The German motor industry has produced high-capacity diesel engines, the prerequisites for the motorisation of rail traffic. The Flying Hamburger was the first herald of this new development, and the experience gained with it led to the creation of an extensive railcar traffic. During 1936 the express railcars of the Reichsbahn covered more than 2·3 million kilometres. Whereas the Flying Hamburger is equipped with two 400 b.h.p. engines, the capacity of the new engines has been extended to 600 b.h.p., so that the new cars are fitted with two 600 b.h.p. engines, giving a total horse power of 1,200. The interior equipment of these cars has been evolved with the object of offering the traveller the highest degree of comfort. In this respect the same principles are applied to railcars as to other passenger coaches.

The rapid increase in running speeds in connection with the introduction of express railcars had to be effected without increasing the risk of accidents. In order to make this possible, the brakes were improved and extensive measures were taken to perfect the signalling system. The distance between the repeater signals and main signals has been increased from 700 to 1,000 metres and their construction has been improved so that even in the thickest fog the driver is given adequate warning of any obstruction ahead and can pull up safely. Moreover, inductive automatic train control has been introduced for all express railcars and express steam engines. This equipment, which was developed in Germany, automatically operates the brakes if the driver should fail to obey a warning or danger signal.

The express railcars have made it possible to do the journey between most of the important German towns and Berlin and back again in one day whilst allowing several hours for the transaction of business matters. It is now proposed to withdraw nearly all the steam trains used for short distance traffic and replace them by railcars. This will make it possible to increase considerably the number of trains. A start has already been made in the Ruhr-Gebiet where simultaneously with the so-called Ruhr Express Traffic a standardised timetable has been introduced. At the beginning of 1937 8·4 per cent. of long distance passenger train traffic was conveyed by railcar.

Railcar-Hauled Trains in Denmark

(*By our Danish correspondent*)

THE through north-to-south passenger service in Denmark known as the Nordpilen, which runs from Frederikshavn, in the north of Jutland, to Flensburg, on the German frontier, has long been hauled by a powerful diesel-electric railcar, belonging to the Danish State Railways. The Nordpilen usually consists of one railcar and one trailer south of Aarhus and two railcars with a trailer between north of that town. Generally, one of the 480 b.h.p. cars of Class MP is used, although these vehicles are not equipped with multiple-unit control. The generally similar 500 b.h.p. railcars of Class MO are fitted with multiple-unit control. But Class MP cars have their maximum output at speeds of 60 to 70 m.p.h., more suited to main-line work, whereas Class MO cars do their best work at 45 to 50 m.p.h., although the top speed of 75 m.p.h. is the same for both types. The use of a few of the MP class on the Nordpilen service is not considered sufficient reason to justify the fitting of multiple-unit control.

Class MO is intended mainly for suburban or outer suburban traffic, but it is necessary to use them also as spare Lyntog sets on occasion, because of the conditions encountered at the ferry terminals. A curious point in connection with the suburban workings of these multiple-unit-control railcars around Copenhagen is that when a train is worked by two of these plus four or five trailers, both railcars are marshalled at the front end of the train, thus necessitating a run-round at the terminal station, although all the trailers used on these services are fitted with the necessary control cables and have been so for a long time. A more obvious method of operation would be to have a railcar at each end, thus avoiding shunting and reducing the necessary turn-round times. I have seen a test train of this formation a year or two ago, but in practice the diesel suburban trains consist either of one railcar with one, two, or three trailers, or of two railcars next to each other and with four or five trailers grouped together behind.

PAXMAN ENGINES.—In the table accompanying the article on railcar acceleration on page 1233 of the December 24 issue of this Supplement, the Paxman 400 b.h.p. engine should have been shown as having eight cylinders; its weight is 5,040 lb. with a cast-iron crankcase. In the same table the fuel consumption figures are in lb. per engine hour.

ENGLISH ELECTRIC ACTIVITY.—Work in hand at the Preston establishment of the English Electric Co., Ltd. includes 107 diesel-mechanical cars being built for the Drewry Car Co. Ltd. for delivery to Argentina; four two-engined Drewry cars for the Nizam's State Railway, four power bogies for diesel railcars for the Tasmanian Government Railways, three 450 b.h.p. diesel-electric locomotives for Brazil, and over a score of Drewry locomotives.

SYRIAN RAILCAR PERFORMANCE.—The four De Dietrich railcars of the Chemins de fer Damas-Hamah et Prolongements, whose performance was described in the issue of this Supplement for April 16, 1937, had covered an aggregate of 535,000 miles to the end of 1937, of which 155,000 miles were covered in the last 18 months without any serious engine failure.

FRENCH RAILCAR ORDERS.—The P.O.-Midi section of the National Railways has ordered eight Renault cars each powered by two 12-cylinder 300 b.h.p. engines, which are to operate from the depot at Limoges. Four similar cars have been ordered by the P.L.M. section. This division also has increased its order for four 600 b.h.p. double-engined Decauville cars to ten vehicles, and is to purchase eight light-weight double-bogie trailers.

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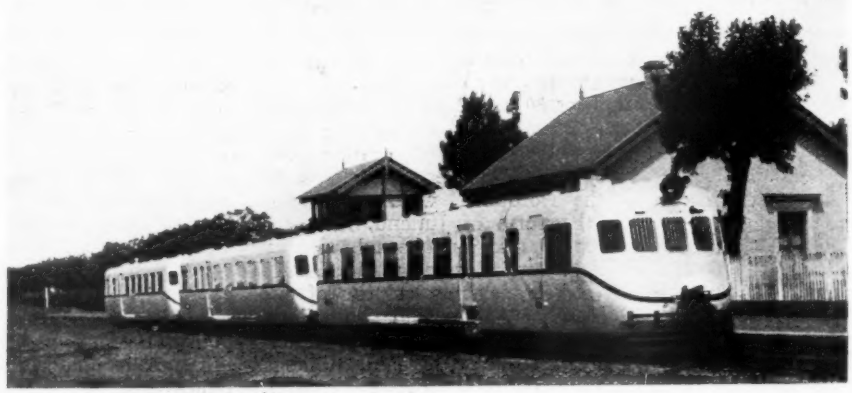
RAILCARS FOR THE FOOTHILLS OF THE ANDES

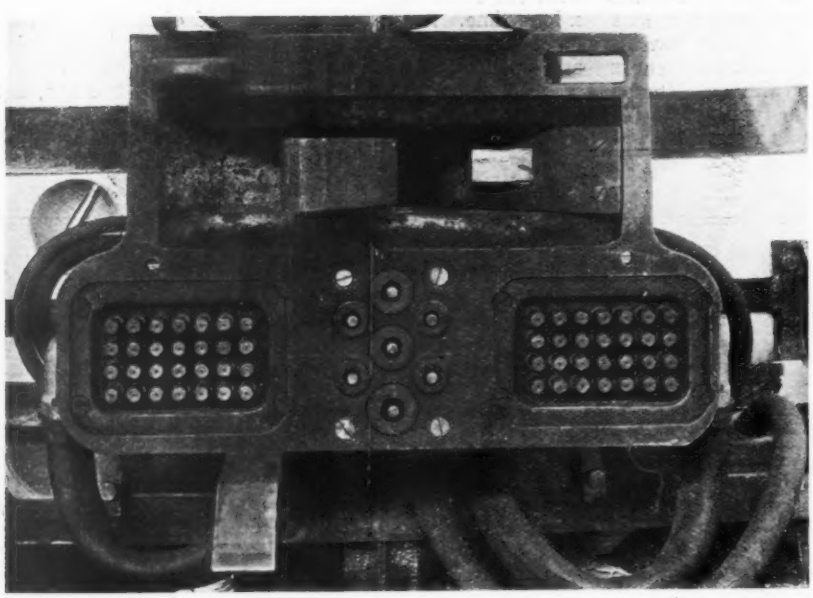
Broad gauge vehicles with interchangeable mechanical and hydraulic transmissions

IN 1936 the Buenos Ayres Pacific Railway requisitioned six railcars of the Ganz type, the bodies and underframes of which were to be built at the railway company's Junin shops. Apart from the bogies, which are of the Kimberley patent type, the mechanical portion was built to Ganz drawings, and the engines and auxiliaries themselves were built in Budapest. Three of the cars have Ganz mechanical transmission and three have Voith-Sinclair hydraulic drive; multiple-unit control is incorporated in both types. The electro-pneumatic multiple-unit control has been combined with an automatic coupling designed and built by the railway. This coupling incorporates all the electrical and air connections for the control of the engine, gearbox, and braking, and the control apparatus has been so arranged that the same system can be used for either hydraulic or mechanical transmission. The coupling consists of two horizontally disposed members which are pivoted in a housing, and this in turn is connected by a universal joint to the drawgear. The act of coupling displaces longitudinally two swinging arms with heavy weights on their extremity, which swing back into place once the coupling members have engaged, and so lock the whole assembly.

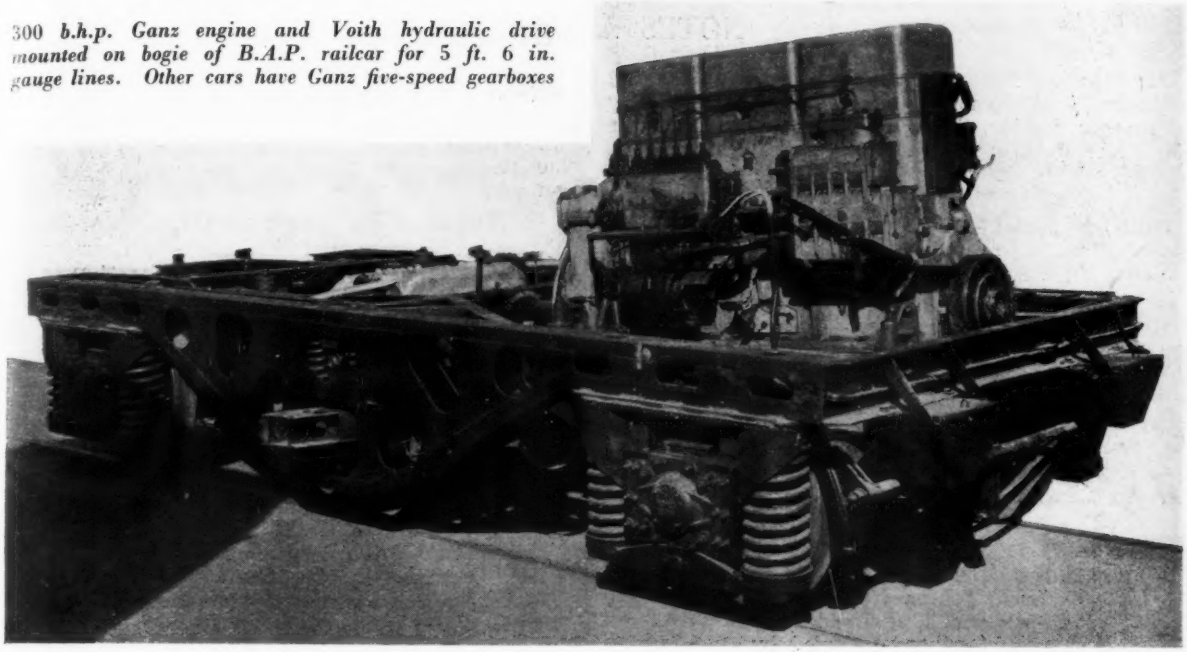
These cars were set to work in the Mendoza district in November, and when going up country to take over this service the three cars with mechanical transmission were coupled in multiple-unit and run from Buenos Aires to Mendoza, 660 miles, in 10½ hr., giving an end-to-end speed of 62¾ m.p.h., non-stop except for a halt of ¾ min. for signals in the Buenos Aires suburban district. The top speed was only 71 m.p.h., the fuel consumption 2,580 lb., and the lubricating oil consumption 51 lb., these figures being the aggregates for the three cars. The fuel consumption was equivalent to 1·28 lb. per car mile. The maximum atmospheric temperature *en route* was 25 deg. C.; the maximum cooling water temperature was 75 deg. C., and the normal difference between inlet and outlet temperatures was 7 deg. C. Towards the end of the run the cars surmounted a 13¾-mile grade averaging 1 in 175, and with a maximum inclination of 1 in 102, at an average

Right: Three single-engined 300 b.h.p. diesel-mechanical railcars running in multiple unit on the Buenos Ayres Pacific Railway





Automatic coupler for the connection of all the electrical and air connections for the control of the engines, gearboxes and braking of the single-engined cars of the B.A.P. Railway. The same type of control is used for both diesel-hydraulic and diesel-mechanical types



300 b.h.p. Ganz engine and Voith hydraulic drive mounted on bogie of B.A.P. railcar for 5 ft. 6 in. gauge lines. Other cars have Ganz five-speed gearboxes

of 65 m.p.h.; the top of the bank is at an altitude of 2,600 ft. above Buenos Aires.

Seating accommodation for 60 passengers, together with lavatory, buffet, and postal space, is provided in each car, and the layout generally is to suit operation over distances of 120 miles or more. The tare weight is 35 tons and in ordinary service the speed will be limited to 62 m.p.h. The interior finish of the cars is carried out in polished walnut and mahogany plywood. Alfol insulation is provided between the inner and outer body shells. The windows are of frameless plate glass running in felt-lined grooves and are of the half-drop type with handle and screw operating gear. They are fitted with wooden louvres running in aluminium frames. The floor is covered with cork and rubber. The seats, which take three and two passengers respectively, are of the reversible type manufactured by the railway company, and are upholstered in blue Rexine. The seat framework, parcels racks, and interior fittings generally are of chromium-plated steel. The lighting equipment and batteries were supplied by J. Stone & Co. Ltd.

Both driving and carrying bogies have the same type of suspension, and were built at the Ganz works to designs prepared by the B.A.P. Railway. The driving bogie has a wheelbase of 12 ft. 11½ in. and as shown at the head of this page, complete with engine and hydraulic transmission, it weighs 11 tons; with mechanical transmission the weight is 12 tons. The design enables the mechanical and hydraulic transmission sets to be changed over if required, and the main difference is that with the hydraulic drive the engine is set at a somewhat steeper inclination. The engine itself is of the Ganz VI JaR 17/240 type, and has a maximum output of 310 b.h.p. at 1,450 r.p.m. Departing from original intentions, the underframes had to be built in Hungary, owing to the difficulty of getting chrome steel in Argentina. The radiators and air compressors are mounted beneath the car underframe and are driven by a long cardan shaft from the transmission set. The cars have an overall length of 66 ft. and an overall width of 10 ft. Both driving and carrying wheels are 2 ft. 9 in. in diameter and those of the carrying bogie are spread over a base of 10 ft.

Opinions

The success and popularity which followed the introduction of super high speed diesel trains both in Europe and the United States of America is such that their operation is now firmly established as a means of transport . . . and it would appear that diesel propulsion has now been established as the principal agent for long distance super-speed railway service.—*Mr. Harold Young, Chief Mechanical Engineer, New South Wales Government Railways.*

The New York, New Haven & Hartford Railroad's diesel train costs 50 cents a mile to operate and its performance might be even better, given cars of lighter weight. The road's diesel streamliner, the *Comet*, continues in public favour with no tendency for its novelty to be outgrown, its gross receipts per mile averaging more than twice its operating expenses.—*Mr. A. H. Seaver, Passenger Traffic Manager, New York, New Haven, & Hartford Railroad.*

On the main lines of the Czechoslovak State Railways and for express trains where the number of passengers carried, although never excessive, fluctuates within a fairly wide limit, we adopted several years ago the happy solution of putting into service a railcar hauling one or two trailers. The coupling is of the ordinary type and a small train powered by diesel engines is thus formed. The engine is of the 400/500 b.h.p. type, but we propose to raise the power by supercharging to about 600 b.h.p. —*Ing. Pavel Koller, Chief Mechanical Engineer, Czechoslovak State Railways.*

The more experience the Burlington has with its diesel trains the better it likes them. The road has run 3,500,000 miles with these trains and has found them highly dependable; in 500 days of both-direction service between Chicago and Denver there have been but 10 failures, and the popularity of the trains continues.—*Mr. Manager, New York, New Haven & Hartford Railroad.*

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NOTES AND NEWS

Air Ministry Locomotives.—The engines to be fitted to the two diesel locomotives to be built for the Air Ministry by Andrew Barclay, Sons & Co. Ltd. are to be of the 150 b.h.p. Paxman type, and Davey, Paxman & Co. (Colchester) Ltd. inform us that they have since received a repeat order.

D.E.U.A. Medal.—The Percy Still medal of the Diesel Engine Users Association for the session 1936-37 has been awarded to Dr. S. F. Dorey, M.Inst.C.E., for his paper on "The Present Position of Special Steel for Diesel Engines."

Horizontal-Engined Railcar.—The German State Railway is acquiring a railcar powered by an improved Vomag eight-cylinder horizontal engine. The Vomag standard engine was described in the issue of this Supplement for February 21, 1936.

D.E.U.A. Working Costs.—The 1936-37 Report on Heavy-Oil Engine Working Costs of the Diesel Engine Users Association was submitted to that organisation on January 13. Unfortunately, it contains no figures relating to rail traction applications.

More Santa Fe Diesel Trains.—At the beginning of April the Atchison, Topeka & Santa Fe Railroad is to begin a service between Chicago and Kansas City with two seven-car stainless steel trains hauled by diesel-electric locomotives. The seating capacity of each train will be about 300.

U.S.A. Diesel Train Success—A total of 82,906 passengers, or an average of about 200 per train per day, were carried by the six diesel-hauled Rocket trains placed in service by the Chicago, Rock Island & Pacific Railroad in August, September, and October last. The four revenue cars of the Peoria Rocket carried 36,613 revenue passengers on two daily round trips from September 19 to December 11, a daily average of 436.

Burlington Zephyr Mileages.—Up to December 31, 1937, the eight stainless steel diesel-electric trains of the Chicago, Burlington & Quincey Railroad made an aggregate mileage of 4,020,707 miles, of which the original 600 b.h.p. three-car Burlington Zephyr introduced in 1934 contributed 461,799 miles. The two 12-car 3,000 b.h.p. Denver Zephyrs running between Chicago and Denver contributed 1,228,544 miles to the total.

Cotal Transmission.—A recent company registration is Cotal Transmissions (Great Britain) Limited, which has been formed to acquire patents for inventions relating to the manufacture and use of gears and transmission systems and devices, &c., and to enter into agreements with the liquidator of Cotal Chadburn Co. Ltd., the Société d'Application des Brevets Cotal, and W. R. Chadburn. The nominal capital is £35,000 in £1 shares.

Union Pacific Trains.—The 5,400 b.h.p. 17-car streamlined train City of Los Angeles began its regular service on December 27, starting from Los Angeles. The existing 11-car 2,400 b.h.p. City of Los Angeles train was withdrawn for overhaul and is being returned to traffic at the end of February; it will then provide with the 17-car train a 39¾ hr. schedule between Chicago and Los Angeles with departures from each terminal every third day. The other 17-car train, City of San Francisco, is about to go into traffic.

70 m.p.h. Diesels in Belgium.—Beginning on February 1, 1938, streamlined triple-car diesel-electric trains have been making single-stop journeys between Brussels (Midi) and Ostend, and will accomplish the 70·8-mile journey in 60 min. including a stop at Bruges (at the station of St. Andre on the avoiding line). The trains will start from each end at 8.50 a.m. and 5.50 p.m., and the speed limit over the whole route will be 87 m.p.h. To enable this speed limit to be extended to the Bruges-Ostend section, the Oudenburg swing bridge has been rebuilt.

Advantages of the Diesel.—For light self-contained units and light trains, the high speed-diesel, or for that matter the slow-speed one—if tractors be adopted—is in a class by itself. It is light, has been developed to a high degree, is reliable, and fuel costs are only about one-third of those of a similar-powered steam engine. It has no stand-by losses, emits no ashes or clinker and, when combustion is good, little smoke. It does not require to take water *en route*, can carry fuel to take it long distances, and, in every way, is suitable for fast and light traction. Light diesel-driven units offer railways a means of giving cheap and frequent services where previously it did not pay to run steam trains, and although the diesel engine is not so flexible as is the steam engine, it having to develop its maximum number of revolutions to give its full power, few railcars will want more than 300 b.h.p., and efficient reduction gears are at hand to this power so that its inflexibility is not too much of a handicap. Hydraulic couplings and electrically-controlled epicyclic gear and reverse boxes in combination with the high-speed diesel engine will give all the flexibility required for light railcar services.—*From a paper "The Economics of Locomotive Engineering," read before the South American Centre of the Institution of Locomotive Engineers by Mr. E. C. Noble, formerly C.M.E. of the Entre Rios Railway.*

N.S.W. Railcar Programme.—According to the recently-issued annual report of the Railway Commissioner, the New South Wales Government Railways' stock of railcars will be augmented by four up-to-date petrol-driven streamlined units. A complete train will consist of a railcar and two trailers, but it will be possible to use the railcars singly, or with one or two of the trailers attached. Seating accommodation has been provided in the railcar for 19 second class passengers; four of the trailers will each seat 59 second class passengers, and four will be of the composite type with 22 first class and 23 second class seats. The interior of each car will be finished in red cedar, and the seats, which will be reversible and comfortably sprung, will be upholstered in blue leather. Wide vision windows will facilitate observation by passengers. There is to be covered gangway communication between cars. The exterior of the cars will be finished in silver and blue. Construction of a number of modern rail buses for country services is in hand. In some districts the running of either a mixed train or a large railcar is uneconomical. Rail buses have been designed to provide these services at much lower cost and at the same time give a high standard of comfort. Information gained from searching trials has proved that running and maintenance costs are very low. The new rail buses will have 18 one-class seats and room for light luggage. They will be streamlined, built of steel, and may be driven from either end. Comfortable seats, with rubber cushions, are to be provided, and the sides and ends will be of glass to afford an uninterrupted view. A feature of the construction will be the safety device fitted to the undercarriage. In the event of the bus wheels becoming derailed the vehicle will fall some few inches on to a transverse skid-bar, which will be equipped with flanges at each end to prevent the car body from leaving the rails.